



**DEVELOPING BUSINESS SOLUTIONS AS A NETWORK-
FOCUSED PROCESS: BEYOND THE “MANUFACTURER-
CUSTOMER” DYAD IN COMPLEX ENGINEERING SERVICE
SYSTEMS**

**An analysis of the evolution of dyadic-triadic relationships in the
Aerospace Industry**

Doctoral Thesis in Business and Management Studies
Specialization in Marketing and Strategy

by

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Abbreviations

CESS - Complex engineering service systems

OEM- Original equipment manufacturer

MRO - Maintenance, repair and overhaul

PhD - Doctor of Philosophy

TV - Television

Abstract

The aim of this thesis is to present how products and services are combined as business solutions in a network-focused process in complex engineering service systems. Using a triad of actors in business networks as the unit of analysis, the thesis expands the business solutions discussion beyond the traditional “buyer-customer” dyadic approach to a “solution set” that considers the evolution of dyadic and triadic relationships. It analyses the combination of products and services as business solutions in a network-focused process through examining the network-based servitization of a manufacturing firm involving multiple actors. Specifically, the aerospace industry and related complex engineering service systems constitute the context of analysis. The research is then applied to a leading aircraft manufacturer (EBR), an airline customer (NATAIR) and four service providers. The findings show that understanding the interplay among dyads and triads in a business network fosters knowledge on product and service combinations as business solutions over time. In particular, providing solutions is not only a matter of unilateral or bilateral adjustments between manufacturing firms and customers, but requires external business model fit and developing relationships among network partners. The thesis proposes a four-phase model for solution relationship development in complex engineering service systems and a typology of business solutions under a new approach to the market and its evolution. This thesis offers theoretical and managerial contributions to business solutions as a network-focused process and thus bridges the gap in literature between business network dyads and triads.

Keywords: Aerospace; Business Relationship; Business Network; Complex Engineering System; Solution; Dyad; Triad

Resumo

O objectivo desta tese é analisar como produtos e serviços são combinados como soluções em um processo focado na rede de negócio. Considerando tríades como a menor unidade de análise em uma rede de negócio, a tese expande a discussão sobre soluções de negócio para além da tradicional abordagem diádica “fornecedor-comprador” para o que se chama aqui de “solution set”, considerando a evolução das relações entre díades e tríades. Esta investigação aborda a combinação de produtos e serviços como soluções de negócio, compreendendo o processo de servitização de uma empresa manufatureira como sendo baseado em rede, envolvendo múltiplos atores. Tendo como foco sistemas de serviço de engenharia complexa, a indústria aeronáutica é o contexto de análise e a investigação é aplicada em uma empresa líder mundial na fabricação de aviões (EBR), uma linha área cliente (NATAIR) e quatro fornecedores de serviços. A investigação apresenta a interação entre díades e tríades em uma rede de negócios e a sua utilidade para o entendimento sobre a combinação de produtos e serviços ao longo do tempo. Em primeiro lugar, a investigação mostra que o fornecimento de solução requer ajuste externo do modelo de negócios. Não é uma questão de ajustes unilateral ou bilateral entre a empresa de fabricação e o cliente, mas um desenvolvimento relacional entre os parceiros da rede. Esses ajustes trazem à luz a ideia de que diferentes fases do relacionamento podem ser identificadas e a tese contribui com a proposição de um modelo de quatro fases para o desenvolvimento de relações para a provisão de soluções em sistemas complexos de serviços e engenharia. A identificação das fases, então, permite a proposta de uma tipologia para soluções de negócio em uma abordagem renovada, como o resultado do mercado e da sua evolução. Esta tese traz contribuições teóricas e gerenciais para a compreensão das soluções de negócios como um processo focado na rede. Assim, ajuda a preencher o *gap* ainda existente na literatura entre díades e tríades.

Keywords: Indústria Aeronáutica; Relacionamentos de negócio; Rede de negócios; Sistemas de serviço de engenharia complexos; Soluções de negócio; Díade; Tríade.

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To my parents and friends!

INTRODUCTION

Chapter 1 - Introduction

1.1 Research Scope and Purpose

The IMP Interactive and Network approaches show that firms are connected by relationships and are embedded in business networks (Easton, 1992; Axelsson and Easton, 1992; Easton and Araújo, 1992; Ford, 1997). In this field, the term network refers to the exchange connection between multiple firms that are interacting with each other (Ford et al, 2006). Relations can be seen as assets that vary in terms of content, strength and duration. It implicates costs of time and money, risks, uncertainties and dependences (Ford et al, 2006; Ritter and Ford, 2004). This way, the management of relationships is not a linear process that leads to an ideal partnership between clients and suppliers. Both parts will try to manage the relation their own way, according to their own priorities. So, it is important to understand that the firms cannot manage the net, but can only manage in the net (Ford et al, 2006).

According to the network approach (Easton, 1992; Axelsson and Easton, 1992; Easton and Araújo, 1992; Ford, 1997) and the interactive approach (Håkansson, 1982), the value creation process occurs through business relationships. Storbacka et al. (2013), Spencer and Cova (2012), Ng et al. (2012), Vargo and Lusch (2011), Töllner et al. (2011), Grönroos (2011, 2006), Vargo and Lusch (2004a,b; 2008) and Ramirez (1999) affirm that value cannot be “added” to an offer. For these authors, value is co-created between several business actors and the buyer, who has a fundamental role in defining what value is (as co-creator). This means that firms cannot offer value and can only suggest ways for a customer to obtain value, implying that service has a fundamental role. For authors such as Ramirez (1999), Grönroos (2006) and Vargo and Lusch (2004a,b; 2008), service is not a special type of product or something added to it. They see services as a framework (Ramirez, 1999) or a process (Grönroos, 2006; Vargo and Lusch, 2004a,b; 2008) that enables value co-creation in business relationships. Jacob and Ulaga (2008) state that business markets are increasingly taking over the character of service markets, forcing traditional product-manufacturing companies to change their position in the goods-services continuum by continuously extending the

business service dimension to their offers (Smith et al., 2014; Reinartz and Ulaga, 2008). Salonen (2011) emphasizes this perspective by highlighting the challenge to move from a goods-based logic to a service-centred logic in a servitization process.

The customized and integrated combination of goods and services to meet a customer's business needs takes the product-service dualism into the business solutions domain (Davies et al., 2006; Windahl et al., 2004). The business challenge for most firms is thus how to generate a variety of revenue streams from both product and service transactions by either adding or integrating services to their core products (Gebauer, 2008; Davies et al., 2006; Teboul, 2006; Araújo and Spring, 2006; Oliva and Kallenberg, 2003). Firms “may decide that providing services is beyond the scope of their competencies (...)” and therefore “not only are new capabilities, metrics and incentives needed, but also the emphasis of the business model changes from transactions to relationship-based” (Oliva and Kallenberg, 2003, p. 161). Authors such as Spencer and Cova (2012, p.1572) emphasize the need to go beyond the dyadic and focal network perspective to incorporate a market-based approach to marketing solutions, “A solution situation is not a buyer-seller dyadic ‘island’. It is multi-partite and not isolated from the ‘rest’ of the market”.

According to Ng et al. (2011), for manufacturers of complex engineering equipment such as in the aerospace industry, long-term service contracts to support complex engineering products are becoming the norm. In complex engineering service systems, firms usually integrate solutions by offering to design and combine components into a system and provide services to operate and maintain the system over its lifecycle (Helander and Möller, 2007). For Ng et al. (2011), the focus on service and achieving outcomes for customers is key to growth, yet the capability to provide services for complex engineered products is less understood. The studies of Smith et al. (2014), Ng et al (2012) and Töllner et al. (2011) contribute with a specific discussion on the customer solution concept in the capital goods industry. Smith et al. (2014) and Ng et al (2012) demonstrate the complexity of the transition from product to service (P-S), highlighting the role and importance of contextual use variety in the P-S transition. Smith et al. (2014) show that the P-S transition cannot be treated as discrete, but as evolutionary stages requiring a complex systems perspective.

Osborne and Ballantyne (2012) and Spencer and Cova (2012) argue that solutions literature has yet to consider issues related to longer-term and broader-scope market dynamics that require going beyond the dyadic and focal network perspective to incorporate a market-based approach to solutions marketing. Considering the evolution of the solutions concept, Spencer and Cova (2012), Kjellberg et al. (2012), Vargo and Lusch (2011) and Töllner et al. (2011) call for empirical studies to clarify the discussion. However, as Spencer and Cova (2012) note, this also requires going beyond the dyadic and focal network perspective to incorporate a market-based approach to marketing solutions.

In terms of the servitization process of manufacturing firms (Smith et al., 2014; Kastalli and Looy, 2013; Salonen, 2011; Kindstrom, 2010), the existing gaps in literature relating to business solutions as a dynamic process developed among firms in a business network (Osborne and Ballantyne, 2012; Spencer and Cova, 2012) and those relating to providing business solution in complex engineering service systems (Ng et al., 2011) lead to the following **research question**:

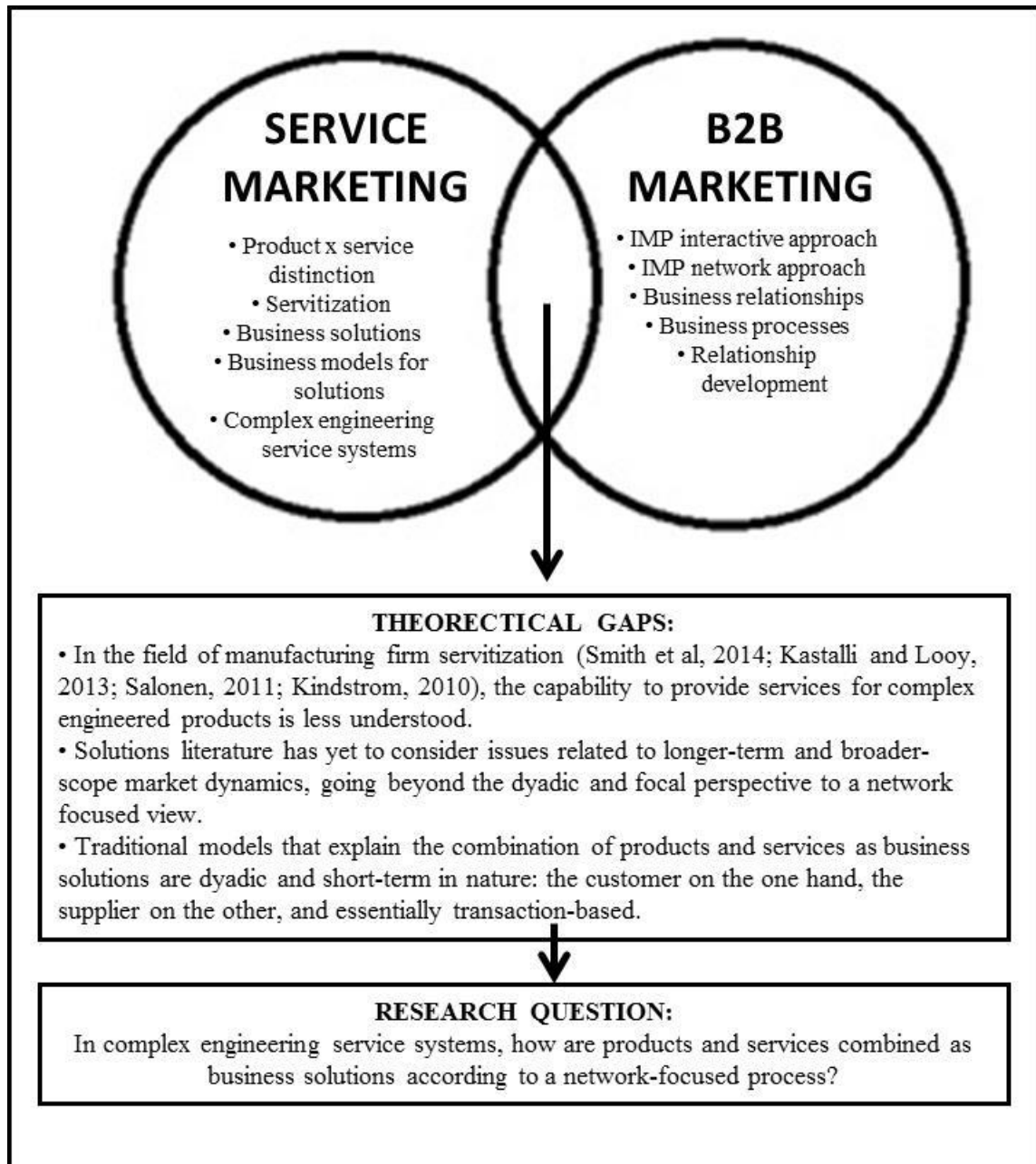
In complex engineering service systems, how are products and services combined as business solutions according to a network-focused process?

This question in turn leads to some subjacent questions:

- How can the provision of solutions as a network-focused process be described?
- How can firms foster relationships to develop business solutions in a business network over time?
- What different types of product-service combinations can be identified as the relationships among partners develop?

The aim of this research is to present how products and services are combined as business solutions in a network-focused process in complex engineering service systems. Extending the discussion beyond the “dyadic buyer-seller approach”, the interplay among dyads and triads of actors in the aerospace industry was examined to provide answers to these questions. Figure 1.1 (in the next page) summarizes the theoretical framework of this analysis. In Chapter 2 of the thesis, the service marketing

Figure 1.1: Theoretical foundations leading to the research question



Source: Author

and business-to-business marketing fields are compared to identify the research gaps in literature that enable developing this study. The thesis is structured in six chapters. The structure of the thesis is described as follow.

1.2 Thesis Structure

This thesis is structured in six chapters, three of which feature papers developed to answer the afore mentioned research question(s). This “*Introduction*” presents the scope and purpose of the thesis and its structure, followed by the methods used to develop the papers. Chapter 2 presents the state of the art of the theoretical background supporting the development of the thesis by presenting the gaps in literature that lead to the research question(s). Chapters 3, 4 and 5 are presented as papers developed in the attempt to respond to the research question(s) (see Table 1.1 as follow¹). Chapter 3 presents the first paper (Paper 1) titled “*The Transition of Products to Solutions: External Business Model Fit and Dynamics*” providing answers to the subjacent question relating to how the provision of solutions as a network-focused process can be described. Referring to business model literature, this paper investigates the relationship developed between a manufacturer of a complex engineering product (EBR) and a customer (NATAIR Airline) to provide solutions in the aerospace industry. Presenting the external fit of the business model and dynamics, and buyer-seller interactions for solutions over time, this contributes to understanding the intricate real-time intertwining of business models among all actors directly involved in the solution network. This research confirms the suggestion that the focus of the business model fit should not be in terms of the product or service but in the interaction and relationships between all parties, highlighting the need to expand the discussion beyond the “buyer-seller” approach. Taking the concept of triads (manufacturer-customer-supplier) as the smallest unit of analyses in a business network (Choi and Wu, 2009a, b), Chapters 4 and 5 present two further papers (Paper 2 and Paper 3) that consider the provision of solutions in conjunction with other suppliers in the business network. The dynamics at play are not those of a triad taken individually but those *between* triads (and the previously constituted dyads) in an integrated solutions perspective forming what is here called a “solution set”. Chapter 4 (Paper 2) presents the paper titled “*A Phase Model for Solution Relationship Development: a Case Study in the Aerospace Industry*”, which provides answers to the subjacent question on how firms can foster relationships to develop

¹ Paper 3 and Paper 5 were published on Industrial Marketing and Management Journal in cooperation with Prof. Bernard Cova and Robert Spencer, from Kedge Business School (Marseille, France). These authors have given contributions related to the discussions of the papers, being the author of the thesis the first author in both publications.

Table 1.1 The three papers as chapters of the thesis

	PAPER 1 (CHAPTER 3)	PAPER 2 (CHAPTER 4)	PAPER 3 (CHAPTER 5)	<u>GLOBAL CONTRIBUTION</u>
Title	The Transition from Products to Solutions: External Business Model Fit and Dynamics	A Phase Model for Solution Relationship Development: A Case Study in the Aerospace Industry	A Dynamics-Based Approach to Solutions Typology: The case of Complex Engineering Service Systems	The thesis expands the traditional dyadic approach to identify how products and services are combined as business solutions. The analysis suggests that the interplay among dyads and triads constituting a “solution set” can be useful to understanding the combination of products and services as business solutions over time. Paper 1 shows that the provision of solutions requires external business model fit to develop relationships among partners in the network. The unilateral or bilateral adjustments bring to light that different relationship phases can be identified and the thesis contributes by proposing a four-phase model for solution relationship development in complex engineering service systems as presented in Paper 2. This phase model then enables proposing a dynamic-based typology for business solutions under a market approach and its evolution as presented in Paper 3. The thesis offers theoretical and managerial contributions to understanding business solutions as a dynamic and variable combination of products and services over time, developed through a network-focused process. The thesis concludes that in complex engineering service systems, the triad approach also provides improved understanding and new potential for researchers and managers alike.
Purpose	The aim of this paper is to present how the provision of solutions as a network-focused process can be described.	This paper presents how firms can develop relationships to provide business solutions in a business network over time.	This paper proposes a business solutions typology, considering different combinations of products and services among firms over time.	
Scope	Empirical research using the “manufacturer-customer” dyad to identify the external business model fit and dynamics for developing business solutions with network partners.	Empirical research analysing the interplay among dyads and triads constituting a solution set that enabled identifying a phase model for solution relationship development.	Empirical research analysing the interplay among dyads and triads constituting a solution set that allowed identifying a new typology of business solutions as a dynamic, non-linear and variable network-focused process.	
Data Collection and Database	Seven local visits and 23h of face-to-face interviews with managers of the manufacturing firm (EBR) and the customer firm (NATAIR), an airline operating in the commercial sector. Content analysis using NVIVO10.	Four triads were identified and 33h of face-to-face interviews were conducted. The data is analysed taking the interplay among dyads and triads as a solution set. Content analysis using NVIVO10.	Four triads were identified and 33h of face-to-face interviews were conducted. The data is analysed taking the interplay among dyads and triads as a solution set. Content analysis using NVIVO10.	
Publication process	Paper 1 was published in Industrial Marketing Management (IMM) as: Ferreira F., Proença J., Spencer R., and Cova B. (2013). The transition from products to solutions: External business model fit and dynamics, <i>Industrial Marketing Management</i> , 42, 1093-1101.	Paper 2 was presented as a competitive paper and published in the Proceedings of the Industrial Marketing and Purchasing Group Conference, Bourdeaux, France, 2014. The paper is also in the third round of reviews in an ISI Web of Knowledge Journal.	Paper 3 was published in Industrial Marketing Management Journal (IMM) as: Ferreira, F.; Proença, J.; Spencer, R.; Cova, B. (2016). A Dynamics-Based Approach to Solutions Typology: A Case from the Aerospace Industry, Article in press.	

Source: Author

business solution in a business network over time. This paper proposes a phase model for solution relationship development, considering the evolution of dyadic and triadic relationships as a way of describing how firms can develop relationships to provide business solutions over time. The identification of the phases presented in Paper 2 led to developing Chapter 5 (Paper 3) titled “*A Dynamics-Based Approach to Solutions Typology: The case of Complex Engineering Service Systems*”. This paper presents a dynamics-based approach to the solutions typology and bridges a gap in literature related to the classification of business solutions beyond the buyer-seller dyad typology approach, taking business solutions as a dynamic and network-focused combination of products and services that can vary over time. This contributes to the discussion on the servitization of manufacturing firms in a network-focused approach and to understanding how solutions can vary and are provided by multiple parties in a business network.

Finally, Chapter 6 presents the conclusions of the thesis with an overview of the theoretical and managerial contributions. Limitations and future research avenues are also presented. Figure 1.2 provides an overview of the structure of the thesis. The next section presents the methodology used to develop this thesis.

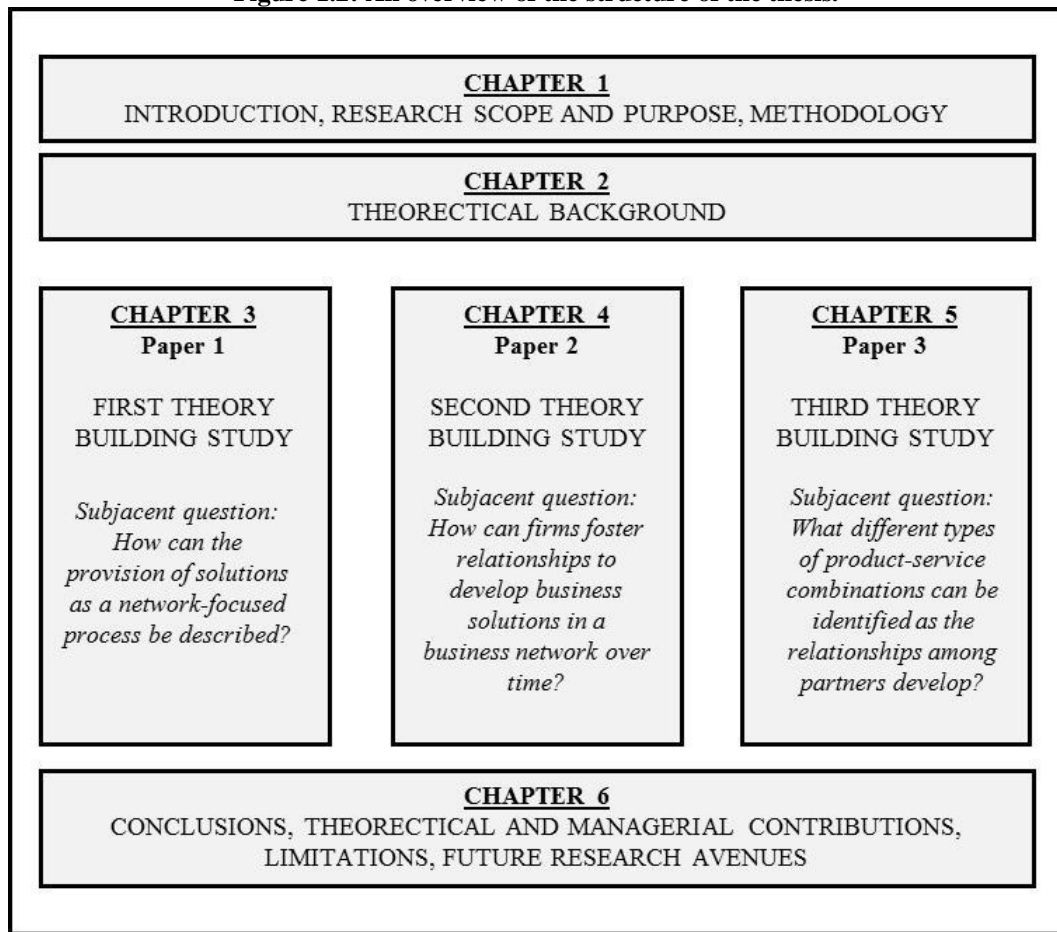
1.3. Methodological Approach

This section concerns the methodology used in this research. The study first adopts an epistemological perspective, thereafter explaining the research objectives. The case study approach used considers both single and multiple cases. After explaining how this research strategy fits the theory development process and purpose, the research methods and instruments are discussed.

1.3.1 Case Study Research

Ramsay (1998) affirms that researchers need to consider the methodological underpinnings of their work, since these direct the choice of research techniques and clarify the philosophical limitations of interpreting the research findings and the reliability of generalizations. According to authors such as Easton (2003) and Ramsay

Figure 1.2: An overview of the structure of the thesis.



Source: Author

(1998), the methodology concerns the analysis of how the research is conducted rather than the methods or techniques employed when carrying out research.

This thesis falls into the category of exploratory research, is qualitative in nature and uses the case study approach. According to Byrne and Ragin (2009), Yin (2003) and Ragin (1992), case study research investigates contemporary phenomena within their real life contexts using multiple sources of evidence. Dubois and Araújo (2007) examine the application of qualitative research and the use of case studies particularly in purchasing and supply management, discussing single and multiple case designs. These authors illustrate the problems of case study research with a number of examples and formulate some rules for conducting good case study research while exemplifying several that rely on single in-depth studies. Dubois and Gadde (2002) highlight the interest and relevance of single case study research for theory development. Some authors argue that a single case study is justified or even preferable in some conditions

(Easton, 2003; Siggelkow, 2007). According to Easton (2003), compared to a multiple case study, single case studies can demonstrate the effect of a large number of powerful and active contingent relations through the particular ways in which they operate. Easton (2003) then suggests that the relationship with existing theory is important, but when little theory exists, a single case can be enough to begin to develop the theory creation process. Through critical realism, he justifies and demonstrates that one case study is sufficient to structure the way of arguing the research results. Other authors such as Eisenhardt (1989) and Eisenhardt and Graebner (2007) argue that for theory building purposes, the use of multiple cases is likely to create more robust theory and can augment external validity and help guard against observer bias (Eisenhardt and Graebner, 2007; Yin, 2003). This thesis uses both the single and a multiple case study approach.

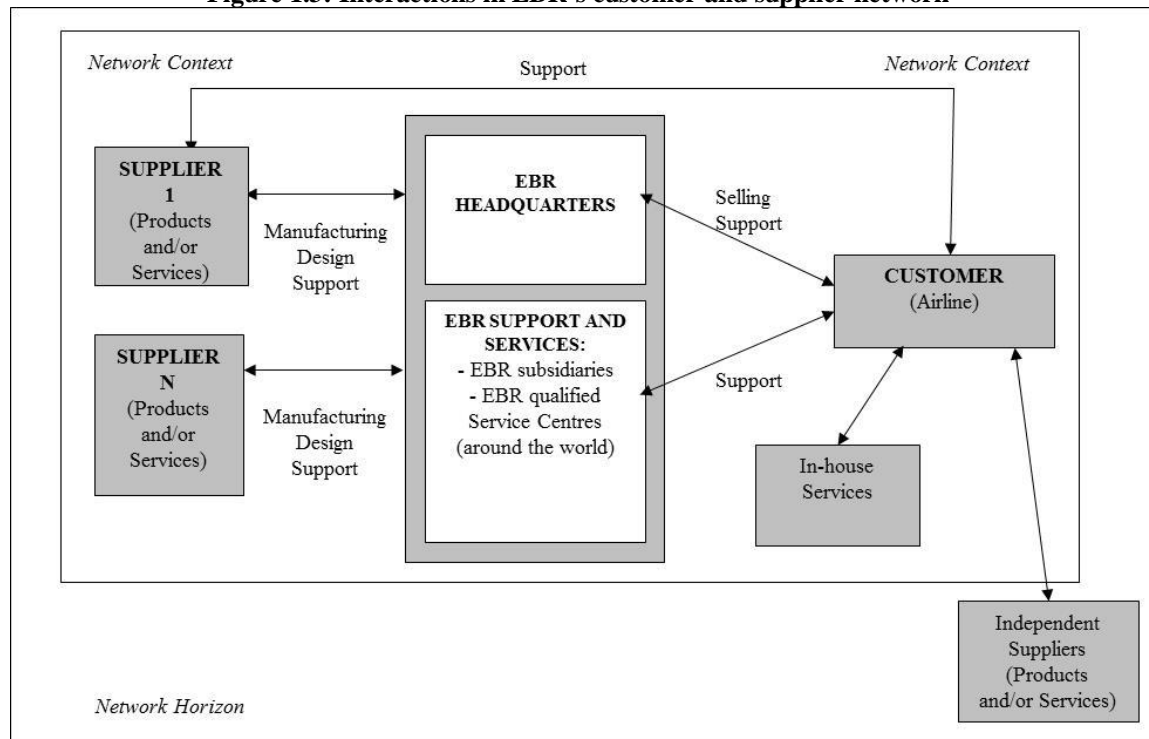
1.3.2 Research Context

In a similar vein to recent research on complex engineering service systems (Ng et al., 2012), this study investigates the aerospace industry where aircraft, helicopter, engine and other major equipment manufacturers and suppliers are increasingly becoming solution providers by integrating product and service support elements. The selected company (focal firm) is EBR, the third major aircraft manufacturer in the world. This company has 40 years' experience in designing, manufacturing, selling and supporting aircraft for the global airline, defence and business aviation markets with around 5000 aircraft and operating in 88 countries in five continents. To compete in the global market, EBR offers specific aircraft for three segments (commercial, defence and executive aviation) as well as services to support these businesses. To support its customers and provide after-sales services, EBR created the Aviation Services business unit, which encompasses aircraft maintenance, spare parts, training and aeronautical systems. Beyond the EBR-owned companies specializing in these types of activities, EBR has its own workshops and parts warehouses around the world. EBR has developed a series of relations among its own service units as well as with customers, suppliers and partners. Figure 1.3 illustrates the relations between the customer (an airline), the EBR units and its suppliers.

1.3.3 Sampling and Unit of Analyses

Considering a triad as the smallest unit that captures the essence of a network (Vedel et al., 2012; Van der Valk and Van Iwaarden, 2011; Peng et al., 2010; Choi and Wu, 2009a, b), this thesis uses as the unit of analysis the triad of actors resulting from a solution-selling approach. Typically, a triad of actors is involved in any outsourcing situation: the buyer, the supplier and the buyer's customer. In manufacturing, the buyer acts as a bridge between the supplier and the customer, maintaining this bridge position before, during and after outsourcing (Choi and Wu, 2009a, b). Once the triad is formed,

Figure 1.3: Interactions in EBR's customer and supplier network



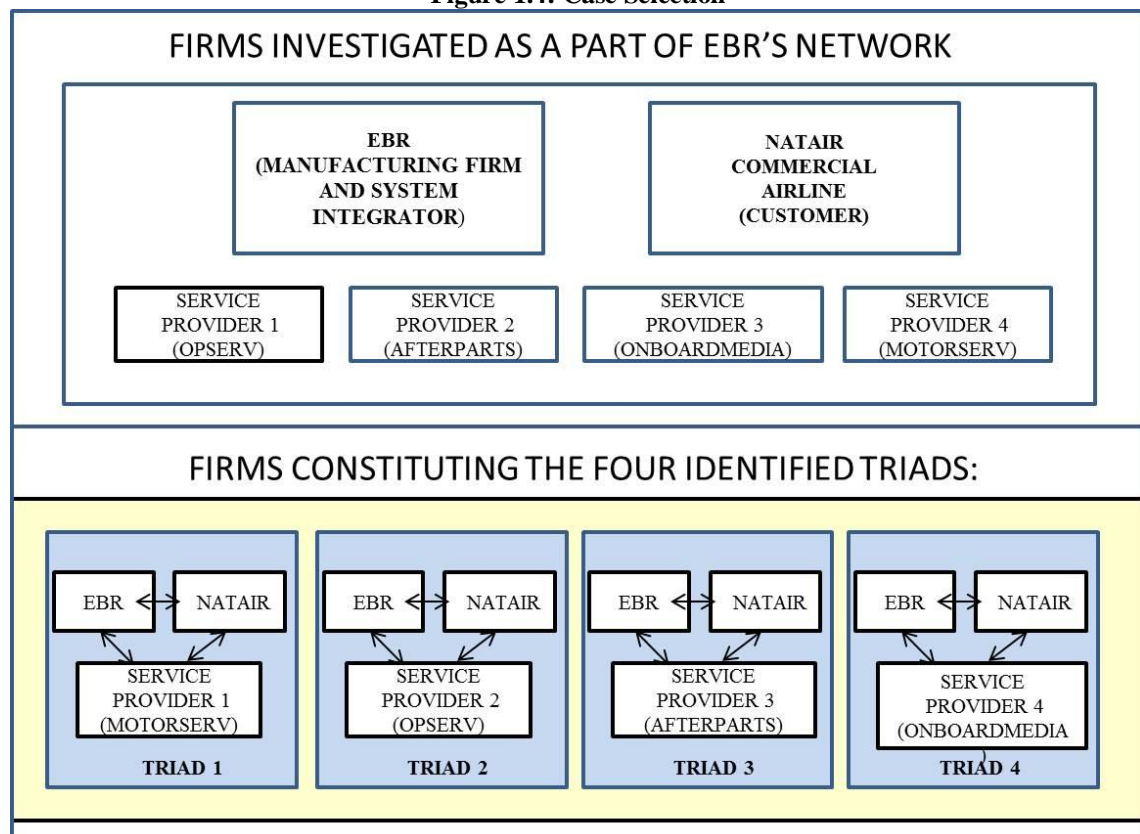
Source: Author

the complexities increase and take on network characteristics. In this thesis, one of the largest aircraft manufacturers in the world (EBR) is selected as a solution integrator interacting with a customer and third parties for the provision of complex engineering solutions (Kaelen, 2014). For a clearer understanding of solution provision over time, four triads are identified as cases involving firms operating in the same national market. The case study focuses on relationships involving six firms: the aircraft manufacturer

(EBR), its major national customer (NATAIR Airline) and four service providers: two maintenance and repair service firms (MOTORSERV and OPSERV), one aftermarket services firm (AFTERPARTS) and one onboard entertainment services firm (ONBOARDMEDIA). These service providers offer “component services” (Van der Valk et al., 2009), which are part of the acquiring organization’s value proposition to its customers (i.e., all providers offer products or services to NATAIR that are part of EBR’s value proposition).

Each triad, as the unit of analysis, is constituted of EBR as manufacturer, NATAIR as customer and a service provider. EBR is the common triadic actor in all cases while serving as key informant to facilitate the comparison of dynamics across the identified triads. Figure 1.4 illustrates the selection of cases.

Figure 1.4: Case Selection



Source: Author

The dynamics at play are not those of a triad taken individually, but rather those between triads in an integrated solutions business approach to form what is here called a “solution set”. This draws attention to the relationship dynamics between triad members

across the triads and the way *ménage à trois* situations develop based on a focal dyad. For reasons of confidentiality, the names of the companies and respondents have been disguised. The customer and the four service providers are detailed below.

- **THE CUSTOMER: NATAIR AIRLINE** was founded in 2008. In less than five years, NATAIR has grown to capture a 17% market share in its country as the nation's third largest airline. The airline's business model focuses on stimulating traffic and boosting the national economy through a formula combining low prices and high quality service. NATAIR has thus developed strategic routes connecting medium-sized and small cities via secondary airports. At start-up, NATAIR benefited from the help of GreenFly - a US company with the same founder - and started operations with EBR aircraft rented from GreenFly. The airline flies 143 aircraft to 105 cities across the country. For EBR, NATAIR represents its main national customer with whom it can develop business and, at the same time, a customer who can help EBR develop its national market for E-Jets.
- **THE SERVICE PROVIDER: MOTOSERV** is the maintenance and repair business unit of a world-leading provider of commercial and military jet engines and aircraft components. MOTOSERV has operated in the market since 1976, aiming to lead the overhaul and repair business of turbine aviation in Latin America. MOTOSERV services include engine maintenance and repair, components overhaul, engineering projects with technical support and technical training. With an extensive global service network to support its activities, MOTOSERV has some global competitors that provide engine overhaul and repair services. However, the current generation of engines use highly sophisticated technology and, naturally, the manufacturers keep their know-how to themselves and generate revenue not only from engine production but also from servicing their own products. With limited access to key technical information, other market players had little power to oppose the manufacturers' entry into the MRO market.
- **THE SERVICE PROVIDER: OPSERV** is a maintenance and repair service provider. Controlled by a foreign group since November 2005, the company became

an independent MRO (maintenance, repair and overhaul) firm in 2001, albeit with over 80 years' international recognition inherited from its former controller. The company's production teams perform a range of services that fulfil customer needs in the commercial area: daily and overnight checks, components overhaul, engineering projects with technical support, interiors projects and overhaul, avionics systems and installations projects, airframe repair projects and technical training improvement. OPSERV is a qualified service centre indicated by EBR offering line and condition-based maintenance. As part of the EBR service centre network for the commercial area, OPSERV has competitors in this network (other EBR authorized service centres) and independent service providers that can be chosen by customers.

- **THE SERVICE PROVIDER: AFTERPARTS** is a leading aviation parts and service provider. Among landing gear for commercial jets and critical components for the latest turbofan engine, AFTERPARTS offers over 900,000 different part numbers to its customers globally. The company describes itself as a provider of a portfolio of solutions that address the industry's logistics, warehousing, program management and sourcing needs, offering services related to repair management, asset management and distribution. As a leading supplier in the aftermarket, AFTERPARTS is an exclusive distributor of parts on behalf of aircraft manufactures around the world. AFTERPARTS competitors include OEM (original equipment manufacturer) and/or MRO (maintenance, repair and overhaul) firms that provide the same type of services. However, as an exclusive EBR OEM, AFTERPARTS has a greater advantage in relation to EBR customers.

- **THE SERVICE PROVIDER: ONBOARDMEDIA** is a major provider of in-flight entertainment systems. Its main products include seat-back satellite television, movie programming and on-board Wi-Fi connectivity. The system also offers live flight tracking for those who want to see where they are. Depending on the region the airline operates in, different satellite television providers are utilized. The company is one of the four main manufacturers of in-flight entertainment systems. Since 2012, the firm provides in-flight TV to NATAIR. As NATAIR is the only

company in its country that has in-flight TV, this on-board service is sold as one of its main unique selling points to customers.

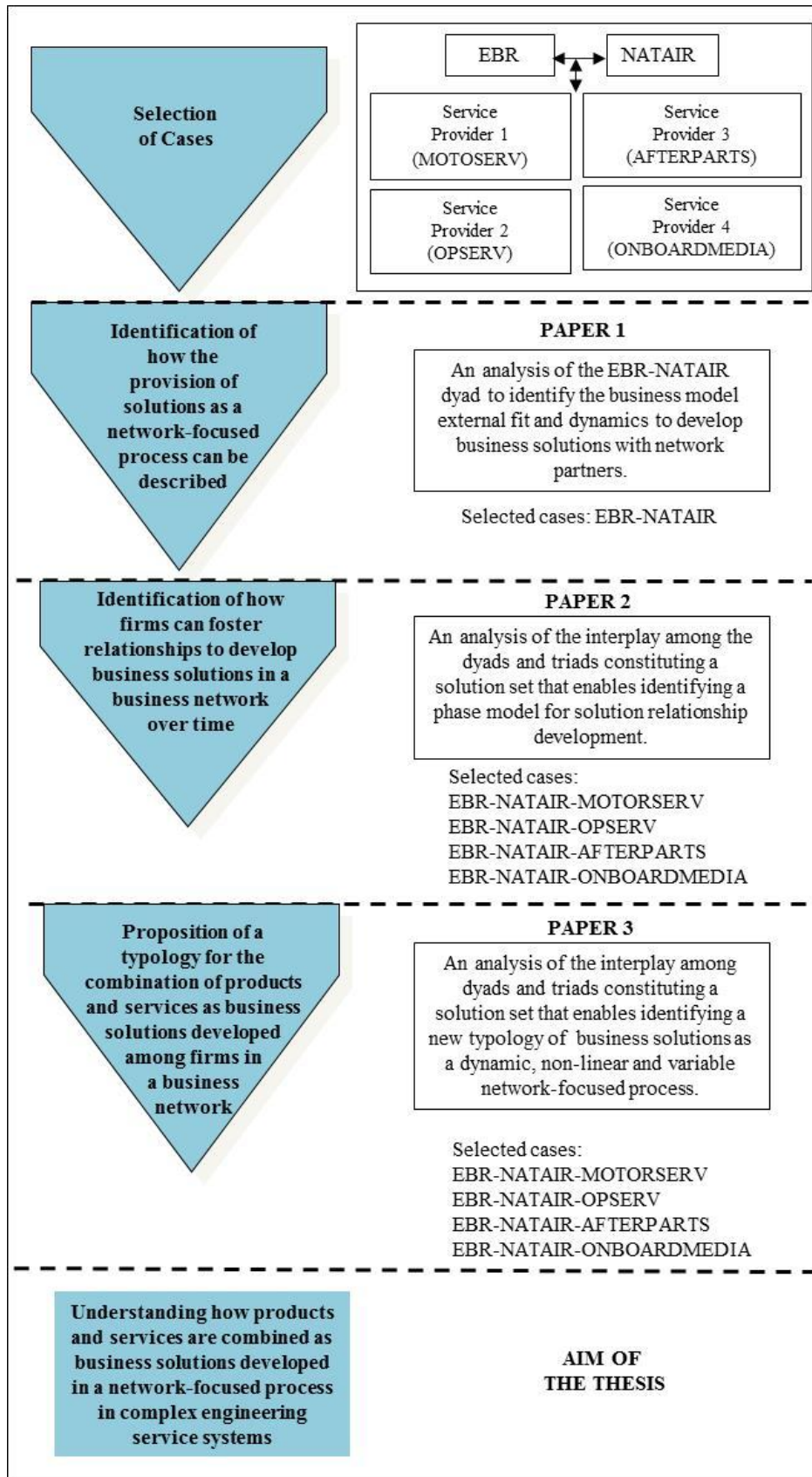
Figure 1.5, as follow, summarizes the research development seeking to answer the thesis research question(s). The case study research, sampling and case selection in this thesis has three focal points: 1) a specific aircraft manufacturer (EBR) and its integrated solutions approach, which offers the advantage of providing an overview of the focal firm while also supporting the development of managerial implications. The second level of focus concerns the dyad comprising the aircraft manufacturer and the customer (NATAIR), emphasising their contract to supply a batch of E-jet aircraft. This provides better understanding of the role of this type of dyad in developing associated relationships in the network. The third level of focus includes all individual triads related to the EBR solution approach and selected from amongst all possible triads to observe variations across these while also highlighting and contrasting those triads involving the same aircraft manufacturer-customer dyad and those involving different customers (not involved in the same dyad). The cases thus chosen either predict similar or contrary results (Yin, 2003).

In the first paper (Chapter 3), the unit of analysis is the supplier-buyer relationship as part and parcel of the network. This can be seen as a case of EBR developing relationships with a customer (NATAIR) or a case of two firms interacting and adjusting their solution provision business models. Chapters 4 and 5 extend the data collection to a network approach, considering as the unit of analysis the triads of actors as the buyer, the supplier and the buyer's customer to build understanding of product-service combinations as business solutions in a network.

1.3.4 Data Collection and Analysis

The three papers together develop this exploratory and qualitative research. In view of the aim of each paper, local visits were undertaken to understand the structure of the firms. Secondary material including articles and technical publications were used as an important source of information and to corroborate the comments and opinions of the interviewees.

Figure 1.5 Research development and cases



Source: Author

Fourteen face-to-face interviews were conducted for a total 33 hours as detailed in Table 1.2 as follow:

Table 1.2 Interviews

INTERVIEWEE CODES	INTERVIEWEE FUNCTIONS	INTERVIEWS/DURATION
AIRCRAFT MANUFACTURER		
EBR		
EBR 01	Technical Coordinator, Engineering Specialization Program	1x3 hours + 1x2 hours of face-to-face interviews 1x30 min telephone interview
EBR 02	Manager, Customer Support and Services Development	1x2 hours + 1x2 hours of face-to-face interviews
EBR 03	Senior Manager, Systems Engineering	1x2 hours face-to-face interview
EBR 04	MRO Services Engineer	1x1 hour face-to-face interview
EBR 05	MRO Services Engineer	1x1 hour face-to-face interview + 1x30 min telephone interview
CUSTOMER FIRM		
NATAIR (Airline in commercial area)		
Interviewee NATAIR 01	Chief Operating Officer	1x1 hour face-to-face interview
Interviewee NATAIR 02	Maintenance Director	1x2 hours + 1x2 hours of face-to-face interviews
Interviewee NATAIR 03	Maintenance Planning Manager	1x3 hour face-to-face interview + 1x30 min telephone interview
Interviewee NATAIR 04	Technical Coordinator	1x1 hour face-to-face interview
Interviewee NATAIR 05	Technical Engineer	1x1 hour face-to-face interview + 1x30 min telephone interview
SUPPLIERS		
MOTORSERV (aircraft engine maintenance and repair services):		
Interviewee MOTORSERV 01	Senior Sales Manager	1x1 hours face-to-face interview + approx. 30 minutes telephone interview
OPSERV (maintenance and repair services):		
Interviewee OPSERV 01	Sales Manager	1x2 hours face-to-face interview + 1x30 min telephone interview
AFTERPARTS (aftermarket parts):		
Interviewee AFTERPARTS 01	Senior Sales Manager	1x2 hours face-to-face interview + approx. 30 min telephone interview
ONBOARDMEDIA (onboard media entertainment):		
Interviewee ONBOARDMEDIA 01	Business Development Manager	1x2 hour face-to-face interview + approx. 30 min telephone interview

Source: Author

In each firm, at least one manager was interviewed, targeting “informed” managers who had the most knowledge of the relationships established. In each chapter of the thesis related to the papers, the details of the interviews are presented in line with

the focus of each investigation. In Paper 2 concerning the EBR-NATAIR dyad, 23 hours of interviews were used to analyse the data. In Papers 2 and 3, all the interviews are considered, as explained in the chapters. Three interview scripts were prepared: one for those with the aircraft manufacturer, one for the customer interviews and one adapted to the service providers, as presented in Appendixes 1 to 3². Initially, the triads were identified through interviews with managers in the manufacturing firm. Drawing on this identification, the service provider managers and customers were contacted and visits were organized. All scripts contained questions on the development of each dyad (Manufacturer - Customer, Manufacturer-Service Provider, Service Provider-Customer) and the triad (Manufacturer-Service Provider-Customer). Following the case study analysis method (Yin, 2003) and inspired by the grounded theory approach (Strauss and Corbin, 1990; Strauss, 1987), the data collected through the in-depth interviews were transcribed and analyzed following the content analysis technique (Krippendorff, 2004), which consists of a set of procedures to examine the communications mechanisms using a systematic and objective description of the contents of the messages. Three different phases ensued: pre-analysis, exploration of the material and processing the results. The pre-analysis phase consisted in preparing the interview material and fully transcribing the interviewee audios. Thereafter, the material was explored and the results processed from an “open grill”, more appropriate for exploratory research. The units of analysis were sentences, paragraphs and phrases (Krippendorff, 2004). Qualitative data analysis software (NVIVO10, a current version of NUD*IST Non-Numerical Unstructured Data Indexing, Searching and Theorizing) was used for data codification and interpretation. In the next chapter, the theoretical background is presented, followed by the papers developed to answer the thesis research question(s).

² The scripts are presented in portuguese as the original language of the interviews.

Chapter 2

**STATE OF THE ART: THEORETICAL FOUNDATIONS OF THE
THESIS**

CHAPTER 2 - STATE OF THE ART: THEORETICAL FOUNDATIONS OF THE THESIS

Abstract

This chapter presents the theoretical foundations that support the development of the thesis. Two main fields of literature are examined and compared to identify the research gaps. First, the service marketing field is discussed, showing the most recent contributions related to the combination of products and services as business solutions and the concept of servitization. A discussion on triads of actors as the smallest unit of analysis of a business network is also presented to enable extending such discussion on business solutions beyond the “buyer-seller” dyad. Thereafter, established theories in business-to-business (henceforth B2B) marketing are presented with a focus on the contributions in this field to develop understanding of business solutions as a network-focused process.

2.1 Service Marketing

The service marketing field has developed considerably since the end of the 20th century. In the next section, the evolution of the term service is presented, highlighting the implications of this development in the B2B domain.

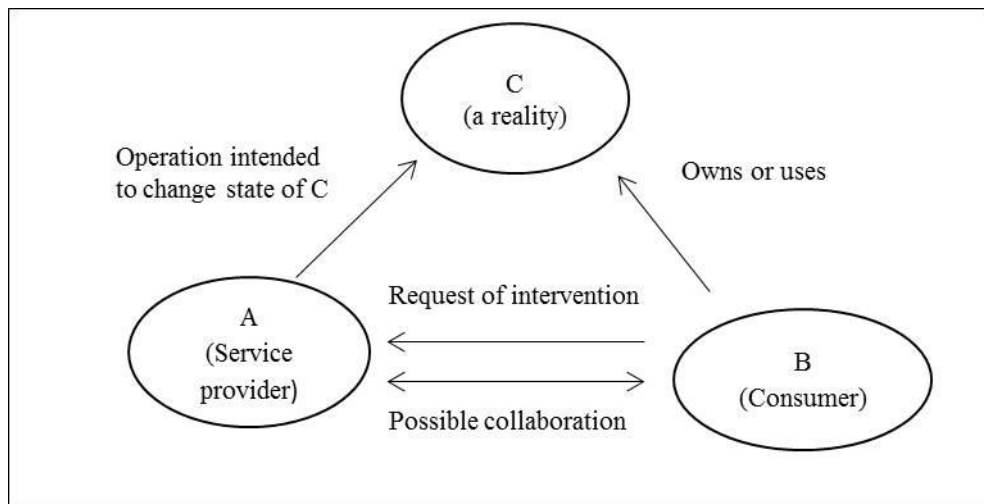
2.1.1 Expanding the term service

Researchers focusing on services over the last decade have emphasized the challenge of moving from a goods-based logic to a service-centred logic (Vargo and Lusch, 2004a,b; Smith et al., 2014; Kastalli and Looy, 2013; Salonen, 2011; Kindstrom, 2010; Reinartz and Ulaga, 2008; Grönroos, 2007, 2006; Campbell-Kelly and Garcia-Swartz, 2007; Teboul, 2006; Oliva and Kallenberg, 2003; Chesbrough and Rosenbloom, 2002). In the service marketing field, service is traditionally conceptualized and defined

as a special type of product. The most common perception is of bundles of products that encompass goods and services (Berry and Parasuraman, 1991), distinguishing services by their four characteristics: intangibility, heterogeneity, inseparability and perishability (IHIP) (Fisk et al., 1993). The characterization of services through these properties predominated in service marketing literature, using a paradigm to classify the offers in the market. Spring and Araújo (2009), Lovelock and Gummesson (2004), Vargo and Lusch (2004a,b), Gadrey (2000), Hill (1999) criticised this distinction of IHIP. For these authors, not all services are characterized by these criteria and it is not possible to claim that these characteristics explain all distinctions between goods and services.

According to Spring and Araújo (2009), the quest for fundamental differences between products and services is misguided. What counts as a product or a service relates to the nature of the producer-user interactions and the institutional structure of production rather than the attributes of products or services. The product-service based on the four (IHIP) idiosyncratic features of services and processes versus outcome consumption does not bear much scrutiny. This notion is based on Hill's (1999) and Gadrey's (2000) studies on an institutional perspective of the service definition. According to Hill (1999), a necessary condition for an item to be a good or a service is that it must be capable of being the subject of a transaction between two or more different economic units. To identify the characteristics of goods or services, the focus should be on the interaction between producers and users. According to Hill (1999), a service is produced by one economic unit for another, but is not exchanged between them. Products can be disentangled from relationships and are capable of independent circulation making them the ideal case for market exchange, but the outputs of services are not separate entities that exist independently of the relationship between producers and users. Thus, Gadrey (2000) developed Hill's (1999) definition by positing that service activity is an operation intended to bring about a change in the status of a reality C that is owned by consumer B effected by service provider A at the request of B and independently of medium C. Spring and Araújo (2009, p. 449) illustrate this notion as shown in Figure 2.1.

Figure 2.1: The service triangle



Source: Spring and Araújo (2009, p.449)

For Spring and Araújo (2009, p. 4), “in summary, the distinction between products and services often depends more on economic factors that determine boundaries and areas of responsibility in a producer-user interaction than on technical factors concerning production process”. According to Callon et al. (2002), the production, circulation and use of products should not be separated, thereby forming a range of services normally associated with these activities. Araújo and Spring (2006) thus affirm that Ford et al.’s (2003) idea of focusing on a mixed product-service combination is a helpful start to overcoming the service-product dualism. The predominant view in literature on customized and integrated combinations of goods and services to meet a customer’s business needs thus constitutes the concept of solutions (Tuli et al., 2007; Kapletia and Probert, 2010; Araújo and Spring, 2006); Ford et al., 2003) or integrated solutions (Davies et al., 2006; Windahl et al., 2004).

2.1.2 Solutions in Business Networks

Given this view in literature of solutions as a customized and integrated combination of goods and services to meet a customer’s business needs (Galbraith, 2002; Davies et al., 2006; Sawhney 2006), Spencer and Cova (2012) argue that the concept of solution marketing has moved from a firm-centric logic to a dyad-centric

logic to a market-centric logic. In the first case, the discussion focuses on issues relating to the combination of products and services as the content of offerings and, more particularly, the service dimension of offerings. The combination of elements that make up these offerings and the degree of their integration in the customer's value chain constitute a point of discussion (Ceresale and Stone, 2004; Oliva and Kallenberg, 2003; Galbraith, 2002). The firm-centric logic of solutions relates to the development of value propositions often considered as "business solutions", "integrated" or "total" solutions (Davies et al., 2006; Stremersch and Tellis, 2002; Stremersch et al., 2001). Instead, the discussion on value co-creation (Normann, 2001; Vargo and Lusch, 2006) led to the concept of solutions in a dyad-centric approach. Tuli et al. (2007) observe that extant literature and suppliers view a solution as a customized and integrated combination of goods and services to meet a customer's business needs, yet conversely, customers view a solution as a set of customer-supplier relational processes. In a study comparing the opinions of customers and suppliers, Tuli et al. (2007) identify that a solution can be understood as a set of customer-supplier relational processes comprising the definition of customer needs, customization and the integration of goods and/or services, their deployment and post-deployment customer support, all aimed at meeting customer business needs. According to these authors, solutions are co-created by a customer and a supplier in a dyadic perspective. In this perspective, customers expect a solution to include processes aimed at understanding their requirements, customizing and integrating products, deploying them and supporting them on an ongoing basis (Tuli et al., 2007). The concept of solutions is not seen as a "business solution" provided by the supplier, but is reconceptualised into the term "customer solutions" (Spencer and Cova, 2012).

Nevertheless, Osborne and Ballantyne (2012, p.156) argue, "a firm-centric logic is at odds with marketing's customer-centric aims". For Spencer and Cova (2012), value co-creation is less likely to occur in a linear way through value chains, but rather emerges from the notion of a value creation network. In this sense, solutions are described in a market-centric logic, co-created by different actors who veritably shape the markets and the networks they engage in. Based on market-shaping theory (Kjellberg and Helgesson, 2006, 2007), Spencer and Cova (2012) describe solutions as a reciprocal market-shaping process. Value is co-created between the supplier and

customer (and related network actors) in addition to other market actors, while solutions can be seen as a “market solution” and not just a “customer solution”. In this sense, “a solution is in itself a discourse on the market and its evolution” (Spencer and Cova, 2012, p. 1584). Market actors shape the exchange taking place as well as the outcomes or expectations in terms of value.

According to Kapletia and Probert (2010), the concept of solutions can be used to describe complex product-service offerings such as aerospace and defence systems. The business challenge for most firms is how to generate a variety of revenue streams from both product and service transactions, as recent literature on expanding the role of manufacturing through servitization suggests, either adding or integrating services to their core products (Gebauer, 2008; Davies et al., 2006; Teboul, 2006; Araújo and Spring, 2006; Oliva and Kallenberg, 2003). Firms “may decide that providing services is beyond the scope of their competencies (...)” and therefore, “not only are new capabilities, metrics and incentives needed, but also the emphasis of the business model changes from transactions to relationship-based” (Oliva and Kallenberg, 2003, p. 161).

2.1.3 Servitization of Manufacturing Firms

The last few decades have seen a transition in business offerings from products to services to solutions (Salonen, 2011). B2B relationships have undergone a major upheaval with the emergence of so-called solution selling or solution marketing approaches (Sawhney 2006; Tuli et al., 2007). In providing solutions, firms develop the capabilities and organizational structures required to combine the physical components and services of a variety of internal and external suppliers (Davies et al., 2006). The business challenge for most manufacturing firms is how to offer solutions generating a variety of revenue streams from both product and service transactions, as recent literature on expanding the role of manufacturing suggests (Araújo and Spring, 2006). Howells (2000, p. 15) identifies two different methods by which manufactured products are offered to consumers not in their own right, but as part of a package that includes service components: a) manufactured products provided with closely aligned services, and b) manufactured products supplied to consumers as a vehicle to access services, i.e., in cases where the product is not the end point of the transaction, but only the beginning

of the relationship between consumer and producer. For Howells (2000), these types of service/product relationships represent forms of what is termed “service encapsulation” where services are wrapped around or embedded in products and can produce innovations in other sectors of the economy.

According to Bryson et al. (2004), four different forms of manufacturing firms transform themselves into either partial service companies or complete service companies (see Table 2.1). Spring and Araújo (2009) affirm that the servitization process in manufacturing firms highlights the role of business model literature (Morris et al., 2005; Schweizer, 2005; Magretta, 2002) to understand how firms can fit strategic, operational and economical decisions to offering products and services.

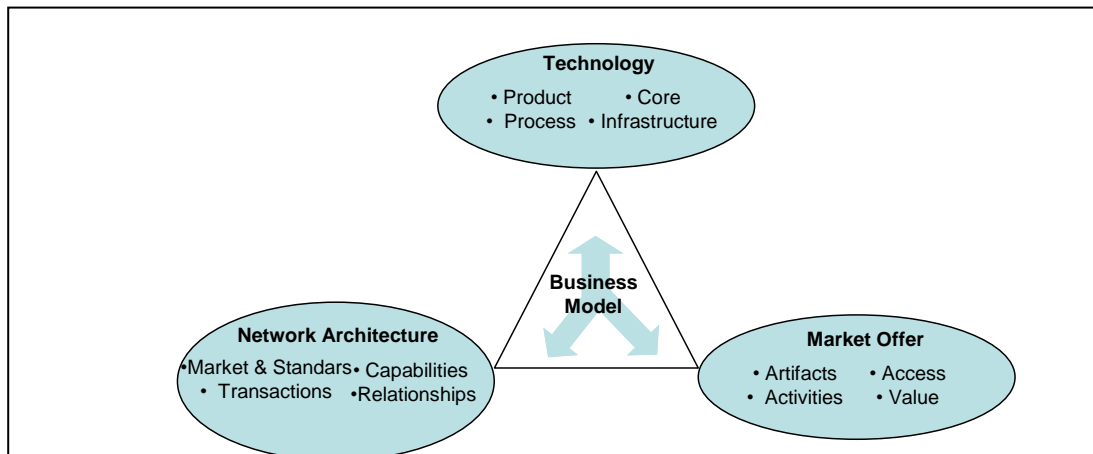
Table 2.1: Different forms to manufacturing companies transforming into service

1. Manufacturing-service companies	A firm that has begun to sell services linked to physical products. This is the first stage towards becoming a full service company.
2. Service-manufacturing companies	The manufacturer still produces products but the balance of activities shifts towards services. Through the servicing process, product manufacturing firms can learn and develop new products or redesign.
3. From manufacturing to service companies	The manufacturer once produced or sold goods, but is no longer engaged in these activities. The company begins to sell knowledge-products but rapidly realises that the sale of such products is more profitable than either producing or selling goods.
4. Virtual production companies	The manufacturer is no longer directly engaged in the physical production of products, having closed or sold its manufacturing plants or never been involved in the production process. Products are designed and marketed, but the production process is undertaken by service manufacturing companies that may not produce a product in their own right and instead manufacture and even design products for other companies.

Source: Adapted from Bryson et al (2004)

The issue of services in business models is for Mason and Spring (2011, p.1035) a “total solution” market offering, which is valuable to customers and will depend in part on their ability (or otherwise) to provide the solution for themselves. As illustrated in Figure 2.2, Mason and Spring (2011) identify three core elements of business models: market offering, technology and network architecture.

Figure 2.2. Business model elements



Source: Mason and Spring (2011, p.1034)

For these authors, the notion of market offering captures open-mindedness with regard to the respective roles of products and services in the business models. Following Araújo and Spring (2006), Mason and Spring (2011) suggest that the market offering concerns the nature of the producer-user interaction rather than any essential feature of a particular product or service. An offering consists of the value-creation opportunity arising from alternative combinations of artefacts, access to supplier capabilities and capacities, and activities performed by the supplier(s) on customers and/or their property. The transfer of ownership of artefacts is still central to many business models. Furthermore, the artefact may be implicated in related episodes of activities or access. Activities are perhaps what we typically have in mind when we think of a “service” and concern what companies do for a customer as part of the market offering. Access-based business models see the provider retaining ownership of the socio-technical capacities (Gadrey, 2000) that play a part in value-creation. Value can be defined as the benefits a customer derives from an exchange. Thus, in solutions literature (Windahl and Lakemond, 2006), for a variety of reasons, industrial customers increasingly see value in offerings based on outcomes achieved by suppliers rather than ownership of capital equipment.

Mason and Spring (2011) also suggest that business models are defined by technological issues. Technology can thus be understood as the use and knowledge of organizational tools, techniques, systems and methods or material products (Kremer,

1993) and can be subdivided into three other classes: process, core and infrastructure. Different firms in the network have differing degrees of direct control over these and depending on the specific case, process, core and infrastructure technologies should not be treated simply as “environmental variables” but as part of the network of internal and external actors that practice the business model (Birkinshaw et al., 2008; Birkinshaw et al., 2007). Process technologies are those used to manufacture products or deliver services. Core technologies underlie particular product technologies. They often dominate managerial practices and have a significant effect on what innovations the organisation identifies, such as specialised chips, small high resolution screens and small long-life batteries. Infrastructure technologies enable connections. In general, these may include the internet, mobile telephone networks and systems for containerised shipping. This type of analysis needs to understand the interplay among and between these technology classes (product, process, core and infrastructure). For Mason and Spring (2011), the dynamic and evolutionary nature of business models becomes clear with the network architecture dimension, subdivided into four key categories: capabilities, transactions, markets and standards, and relationships. Capabilities can be understood as the know-how that is retained, maintained and developed by an organisation over time. The ease with which firms can access network counterparty capabilities is also shaped by the existence and development of markets and standards. As markets are created and evolve, standards emerge alongside them. The standards recognised by firms frame the way managers identify and pursue market opportunities. They are indicative of what is traded and how in any business network. Second, the notion of markets and standards may also help managers frame market-making practices as they seek to influence and shape standards in a strategic move to influence which are adopted (Arthur, 1989). On the other hand, transactions and relationships are important network architecture dimensions. If transactions are established between network counterparties, they are often complemented and indeed enabled by non-financial exchanges and interactions.

Mason and Spring (2011, p.1039) argue, “the value of business models lies in their ability to frame action and reveal connexions between those actions, across multiple levels of analysis”. This requires connecting micro to macro level practices: from the individual actions of front-line workers to the market level actions of

networked organisations. Business models can be understood as bundles of interconnecting practices that evolve with the context in which they are practiced, but these in turn influence and shape the context. Thus, changes in technology practices are likely to lead to changes in the network architecture and so forth (Geiger and Finch, 2009). Business models are thus understood to have multiplying sites over time (Schatzki, 2005). The framework is flexible in the sense that, being non-sequential, analysis can begin from any element(s), depending on current concerns or opportunities. Considerable path dependence seems to exist in the susceptibility of the various elements to innovation as well as unanticipated dynamic interconnections between the elements. However, Mason and Spring (2011) argue that this is not a sustained empirical study. Future research should also focus on generating insights into the proliferation of business models across business networks as technologies, market offerings and network architectures are shared, overlap and interlink. These ideas highlight that the combination of products and services in manufacturing firms as business solutions only can be understood through the relationships between the actors. The IMP Group network approach describes B2B networks and relationships for value creation and the next section presents a theoretical review of this body of literature.

2.2 Business-to-Business Marketing and the IMP Network Approach

In the last 30 years, the B2B marketing field has been mainly developed from studies by the Industrial Marketing and Purchasing (IMP) Group. The IMP Group's interactive and network approaches show that firms are connected by relationships and are embedded in business networks (Easton, 1992; Axelsson and Easton, 1992; Easton and Araújo, 1992; Ford, 1997). According to Håkansson (1982), the initial IMP Group project was developed because researchers had observed phenomena that could not be explained by traditional theoretical models. Until then, the microeconomics perspective predominated, based on price as a market coordination mechanism, emphasizing the ability to achieve transactions in business relationships at better costs. The first IMP Group publication (Håkansson, 1982) set the challenge of studying the specificities of business markets, suggesting a structure of relations between interdependent firms called the interactive approach (Håkansson, 1982). According to this perspective,

buyers and sellers are active participants of a relationship (Håkansson, 1982). For Turnbull et al. (1996), the interactive approach considers the relationship instead of the individual transaction as the analysis unit. The interactive perspective developed by the IMP Group attempted to capture the multi-dimensionality and complexity of inter-business relationships wherein the relationships are embedded (Axelsson and Easton, 1992; Ford, 1997).

IMP Group researchers (Easton, 1992; Axelsson and Easton, 1992; Easton and Araújo, 1992; Ford, 1997) disseminated the interactive approach and developed the network approach. The term network refers to the exchange connections between multiple firms interacting with each other (Ford et al., 2006). Relations can be seen as assets that vary in terms of content, strength and duration, entailing costs of time and money, risks, uncertainties, and dependencies (Ford et al., 2006; Ritter and Ford, 2004). The management of these relationships is a non-linear process that leads to an ideal partnership between customers and suppliers. Both parties will try to manage the relation their own way, according to their own priorities, which implies that firms cannot manage the net, but can only “manage in the net” (Ford et al., 2006). The network approach has had a fundamental role in changing the way firms comprehend business marketing in two perspectives: the business structure and the business process (Ford and Håkansson, 2006). While the structural perspective is accepted, the implementation of the business process is still not well understood by firms. Interactivity and relationships are structural aspects promoting the dynamic exchange of resources between actors in a complex net. Managing in the net, the firm’s business process should permit systematic comprehension of the others party’s needs and make decisions accordingly.

2.2.1 Business Relationships

Anderson et al. (1994) and Ritter and Ford (2004) emphasize that business nets are determined by the connection of relationships. For Håkansson and Snehota (1993), a relationship can be understood as a mutually orientated interaction between two reciprocally engaged parties. According to Ford (1997), business relationships can be

described as complex combinations of exchanges and adaptation. The content of the exchanges can be classified into four types: exchanges of products/services, information, financial and social elements, which lead to a long-term relationship characterized by interdependence, reciprocal adaptations and coordination of certain activities (Ford, 1997). Therefore, the adaptation processes take place when one or both parties realize the potential profit resulting from the relationship and adapt functions, proceedings, tasks, attitudes, values and objectives to obtain better performance. Möller and Wilson (1995) agree with this notion and claim that an interaction between the supplier-buyer can also be described as a coordination process.

For Anderson et al. (1994), a business net is built by dyadic business relationships and reflects the business net in which they are embedded. Relationships between firms can be divided into two different dimensions: primary and secondary functions. The primary function of business relationships concerns the effects, positive or negative, for both parties that interact in a dyadic relationship. The secondary function or “net functions” captures the indirect, positive or negative effects of the relationships (Anderson et al., 1994). In an attempt to clarify this idea, Anderson et al. (1994) discuss some concepts such as net horizons, the context of the firm’s net and identity of the net. A business net is known to stretch without clear limits throughout connected business relationships, however, the “net horizons” depend on the firm’s experience and on the net’s structural characteristics. “Net horizons” can be seen as a firm’s perception of how far the net in which it is embedded stretches. This means that a firm’s net horizons change according to the business relationships it develops. According to Håkansson and Snehota (1993), the part of the net’s horizon considered relevant to the firm is called the “net context” and is structured in three dimensions: actors, activities and resources (Håkansson and Snehota, 1993). It is in the context of the net that the firm develops what is called the “net’s identity”, i.e., how a firm sees itself in the net and how it is seen by other members of the same net. The net’s identity can indicate (or not) the appeal level of the firm as a partner for business relationships and resource exchanges.

2.2.2 Relationship Development

The dyadic buyer-seller relationship dynamics are discussed by several authors, amongst whom, Möller and Wilson (1995), Håkansson and Snehota (1993), Dwyer et

al. (1987) and Ford (1982). Focusing on the models developed to understand the dynamics of the dyadic relationship development process, Dwyer et al. (1987) and Ford (1982) describe phase models of relationship evolution. According to the former authors, each phase represents a major transition in how parties consider one another and can be understood as: 1) awareness, 2) exploration, 3) expansion, 4) commitment and 5) dissolution. The latter author characterizes the process of establishing and developing supplier-customer relationships over time based on the variables of experience, uncertainty and distance, suggesting that such relationships follow a five-stage evolution process: pre-relationship stage, early stage, development stage, long-term stage and final stage/rupture. Traditionally, for Möller and Wilson (1995), Håkansson and Snehota (1993), Dwyer et al. (1987) and Ford (1982), a buyer-seller relationship is unlikely to be formed without bilateral communication of wants, issues, inputs and priorities. Considering the factors that influence the development of the relationships, the authors discuss issues such as expectations, power, dependence, trust and conflicts. Concerning expectation development, firms want to access resources and capabilities to realize value. The buyer and seller assess their mutual investments in the relationship and issues such as power (Dahl, 1957) and dependency between the actors are inevitably factors conditioning the relationship evolution (Emerson, 1962). Trust is another important concept in understanding expectations of cooperation and planning in a relational contract. Trust can be understood as the belief that a party's word or promise is reliable and that it will fulfil its obligations in an exchange relationship (Zhang et al., 2011). These expectations may either enhance or diminish contractual solidarity. The resulting perceptions of goal congruence and cooperativeness lead to levels of satisfaction with the other's role performance and associated rewards. Hence, motivation to maintain the relationship increases (Dwyer et al., 1987).

The dynamics of the dyadic relationship development process described above can provide some clues to understanding the dynamics of solution business relationships. However, considering the complexity of relationships between firms engaged in the provision of solutions, Tuli et al. (2007) and Sawhney (2006) bring specific contributions to the field. Examining solution transactions, Tuli et al. (2007) describe these as “an ongoing, relational process of defining, meeting, and supporting a customer's evolving needs” characterized by “a set of four relational processes” (Tuli et

al., 2007, p. 5). These are: 1) requirement definition: customers are not fully cognizant of their business needs and should have discussions with the supplier to elaborate them, 2) customization and integration: customization involves designing, modifying or selecting products and services to fit a customer's environment and integrate them into a coherent whole, 3) deployment: this refers to delivering the integrated solution and its installation in a customer's environment, 4) post-deployment support: this is more than providing spare parts, operating information and routine maintenance and includes deploying new solutions in response to customers' evolving needs. Sawhney (2006) also identifies the customer activity cycle as the temporally linked sequence of activities in which customers engage to solve a complex problem. This cycle consists of three phases (Sawhney, 2006, p. 372): 1) pre or before: when customers decide what to do to obtain the desired result - searching, deciding, acquiring, 2) during: when customers do what they decided on - installing, using, operating, 3) post or after: when customers keep things going - reviewing, renewing, extending, upgrading and updating. Taken together, the ideas of these authors show that the dyadic process of relationships can be developed through four or five general stages.

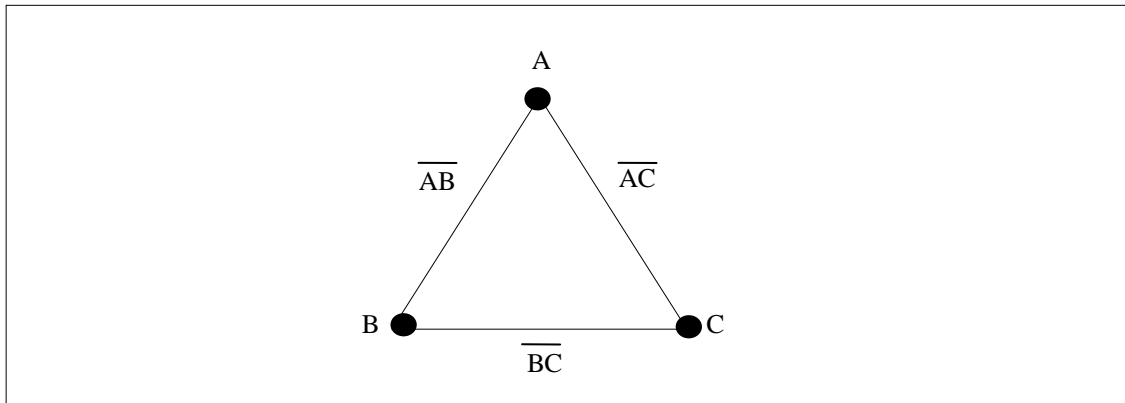
These models bring a valuable contribution to the understanding of solutions. However, as they are one-sided - the customer-side on one hand and the supplier-side on the other - and short-term, being focused on a given transaction, they do not offer a full solution relationship development framework. Tuli et al. (2007, p. 14) emphasize that when solution customers interact with multiple suppliers, this requires developing "relationships not only with a customer but also with other suppliers (...) These conjectures require further investigation". This indicates the need to study how solutions are provided beyond the buyer-seller dyad, as Spencer and Cova (2012) and Vargo (2009) assert. One way of managing the complexity of solutions is to consider triads, as presented in the next section.

2.3 A Triadic Approach to the Solutions Business

"A dyad shows how a node affects another node, but it is not able to address how a link may affect another link (...) A triad can be understood as the smallest unit of a network where this occurs." (Choi and Wu, 2009a, p. 263).

Triads represent a perfect setting to examine business solutions. A triad is the component that captures the basic essence of a network (Choi and Wu, 2009a, b) and allows us to study the behaviour of a network to understand the complexity of business realities. As illustrated in Figure 2.3, in the triad network configuration, a node affects a node (e.g., A affecting B or C) and a link affects a link (AB affecting AC or BC).

Figure 2.3: Triadic configuration



Source: Choi and Wu, (2009a, p.263)

Some authors (Wu et al., 2010; Choi and Kim, 2008; Dubois and Fredriksson, 2008; Rossetti and Choi, 2005, 2008; Wu and Choi, 2005) present different triadic conditions: 1) a buyer interacting with two suppliers, 2) a supplier interacting with an intermediary and an end user, and 3) a supplier interacting with two buyers. Wu and Choi (2005) and Dubois and Fredriksson (2008) consider triads across two tiers of the supply chain. The former study the supplier-supplier relationship in the triadic context of the buyer-supplier relationship while the latter identify a particular type of sourcing called “triadic sourcing”. This sourcing strategy occurs when a buyer works with two suppliers with overlapping capabilities. Rather than imposing a sourcing strategy separately for each supplier, a buyer creates a bundled strategy for two closely-coupled suppliers.

Rossetti and Choi (2005, 2008) investigate a phenomenon that occurs across three tiers of the supply chain (where A is the buyer, B is the buyer’s customer and C the buyer’s supplier). In a traditional relationship arrangement, there would be no link between B and C, and A would be in control of the materials and information flow

between B and C. This lack of connection forms a structural hole that can be defined as the lack of connections between agents or groups that are not directly linked (Burt, 1992). The structural hole concept is closely related to the concept of a bridge (Li and Choi, 2009, p. 29) where agent A spans the structural hole between agent B and agent C and is thus in the bridge position, reaping the benefits that come with this position. In a services context, however, the buyer has no choice but to allow a supplier to directly interface with its customer. The loss of the bridge position is called “supply chain disintermediation” (Rossetti and Choi, 2005). In this context, the buyer sits between its customer and its supplier, and supply chain disintermediation occurs between the customer and the supplier.

Li and Choi (2009) discuss the relationship dynamics in service triads. For these authors, a triad of actors is involved in any outsourcing situation. In services, the relationship structures among the three actors change before, during and after outsourcing. Before outsourcing (i.e., during the contract negotiation stage), the buyer is the bridge between its supplier and its customer. During implementation, this bridge position begins to “decay” as its supplier comes in direct contact with the buyer’s customer. After implementation, the bridge position is intended to be “transferred” to the supplier. However, if left unmanaged, this transferred bridge position has serious performance implications for the buyer. Li and Choi (2009) argue that the buyer should continue to actively interact with its customer and closely monitor the supplier to prevent the supplier from solidifying its bridge position.

Although triads have received attention, including some considerations on dynamics, very few studies contribute to improved understanding of the evolution phases of service triads (i.e., constituting a gap in literature regarding the possible phases of evolution of relations involving three actors in service triads) as in buyer-seller dyadic relationships. Indeed, several authors discuss the dyadic buyer-seller relationship including Möller and Wilson (1995), Håkansson and Snehota (1993) and Dwyer et al. (1987). However, Anderson et al. (1994) argue that the development of business practices entails the need to expand the study of the connections of relationships between firms and their environment. For these authors, a business network is constituted by dyadic business relationships and these, in turn, reflect the business network they belong to.

The dynamics of the dyadic relationship development process described above, along with the work of authors such as Wilhelm (2011), Möller and Wilson (1995), Håkansson and Snehota (1993), can provide some clues to understanding triadic dynamics and the dynamic evolution of a triad. According to Choi and Wu (2009a, b), a triadic framework offers supply chain researchers an expanded vocabulary to describe a complex relationship that is absent if confined to the one-to-one dyadic discussion. In a sense, “this triadic framework takes us from a two-dimensional space to a three-dimensional world, where every action can potentially take on unintended consequences and new relationship arrangements” (Choi and Wu, 2009a: 265). Thus, considering the complexity of relationships between firms in complex engineering service systems and a triad as the key unit of analysis (Van der Valk and Van Iwaarden, 2011), this study aims to contribute to Li and Choi (2009) and Choi and Wu’s (2009a, b) call for better understanding of the shifting relationship structures between parties.

2.4 Comparing the Literature: Theoretical Gaps for the Development of the Thesis

Taking the two fields of investigation - marketing services and B2B marketing - some gaps in literature can be identified. The emergent body of research on business solutions calls for analyses that go beyond the dyadic manufacturer-customer boundary. As the development of relationships can be seen as an evolutionary process, the literature review identifies:

- Authors such as Salonen (2011), Teboul (2006), Oliva and Kallenberg (2003) claim that market complexity is forcing traditional product-manufacturing firms to change their position in the goods-services continuum by continuously extending the service business to their offers.
- With regard to the servitization process of manufacturing firms (Smith et al., 2014; Kastalli and Looy, 2013; Salonen, 2011; Kindstrom, 2010), the focus on service and achieving outcomes for customers is key to growth, yet the capability to provide services for complex engineering products is less

understood (Ng et al., 2011). Ng et al. (2011) affirm that much of literature uses the dyadic firm/customer relationship as the unit of analysis without articulating the broader business nature of complex engineering service delivery.

- Considering the provision of solutions, authors such as Spencer and Cova (2012) and Storbacka and Nenonen (2011) assert the need to go beyond the dyadic and focal network perspective to incorporate a market-based approach to marketing solutions. Traditional studies contribute by considering solutions as a dyadic and linear combination of products and services over time. More recently, studies have been developed on how firms provide business solutions not only as a relational but also a network-focused process. Spencer and Cova (2012), Kjellberg et al. (2012), Vargo and Lusch (2011) and Töllner et al. (2011) call for empirical studies to clarify the discussion.
- Briscoe et al. (2012) and Ng et al. (2011) affirm that much emphasis is placed on the static nouns of a system, rather than on the dynamic verbs that are more significant to facilitate understanding complex outcomes.
- “The integration of products and services as business solutions is still in its infancy to be further advanced (...) and a classification scheme of the integration of products and services is required to yield practical implications for designing and developing integrated offerings.” (Park et al., 2012, p. 529). There is still a gap in literature in relation to the classification of business solutions in this new approach (Spencer and Cova, 2012; Park et al., 2012).
- The evolution of the B2B realm towards the solutions business consequently calls for better understanding of how relationships develop over time in such a new context since the former dyadic supplier-customer relationship models would not seem to enable grasping the complexity of multiple solution relationships (Raddats and Burton, 2014; Vargo, 2009; Tuli et al., 2007). This indicates the need to study how triadic relationships develop over time.

These considerations taken together give rise to the research question of this thesis: In complex engineering service systems, how are products and services combined as business solutions according to a network-focused process? In turn, this main question leads to some subjacent questions, as presented in Chapter 1:

- How can the provision of solutions as a network-focused process be described?
- How can firms foster relationships to develop business solutions in a business network over time?
- What different types of product-service combinations can be identified as the relationships among partners develop?

This thesis draws on the emerging body of solutions literature and focuses on the theoretical gap in considering this concept in relation to established B2B marketing literature. The thesis contributes to our understanding of the combination of products and services as solutions developed among partners in a business network. Considering the triadic approach, the thesis also helps to fill the as-yet unbridged gap between dyads and triads in literature while contributing to understanding manufacturing firm servitization in a network-focused approach. The subsequent chapters present the empirical studies developed to bridge these gaps.

Chapter 3

THE TRANSITION FROM PRODUCTS TO SOLUTIONS: EXTERNAL BUSINESS MODEL FIT AND DYNAMICS

RESEARCH HIGHLIGHTS

- Business models for solutions have to be network-focused and based on relationships.
- The solution provider has to construct its business model as ever-evolving in order to maintain external fit with its customers and suppliers.
- External fit is not a unidirectional fit (the supplier's model relative to its environment) but rather reciprocal fit between multiple actors involved in the solution process.
- The focus for business model fit should be the interactions and relationships between all parties present.
- In the case of solutions, there is an intricate real-time intertwining of business models between all actors directly involved in the solution network.

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CHAPTER 3 - THE TRANSITION FROM PRODUCTS TO SOLUTIONS: EXTERNAL BUSINESS MODEL FIT AND DYNAMICS

Abstract

This article provides empirical evidence and contributes to theory building concerning business model fit and dynamics in the area of solutions business. Business models are seen in this context as going beyond considerations such as offerings and internal processes or even relationships, and as including network and market considerations. Indeed the paper highlights the fact that a business model is not firm-focused, nor dyad-focused, but rather network-, and even market-focused, demonstrating that a business model is not static, but dynamic. Manufacturer and customer continuously shift form and content of their respective business models to adapt both to the needs of the counterpart and to market context. A qualitative case study approach is adopted, with subsequent content analysis. The case study relates to the aerospace industry with focus on a complex engineering firm, one of the largest aircraft manufacturers in the world, its customer – a national airline - and their network partners of various kinds. The data were collected through multiple face-to-face interviews with managers in both companies, as a part and parcel of a network of actors that influences and is influenced by the supplier-buyer relationship. Relationships over time between these firms and network partners are described, highlighting the interplay of products and services related to the provision of solutions. Findings highlight the dynamic nature of business models over the relationship lifecycle between supplier and customer in a complex engineering environment, and the need for reciprocal adjustment of models.

Key-words:

Business Model; Complex engineering firm; External Fit; Product-service interplay; Manufacturing firm; Solution.

Introduction

Market complexity is forcing traditional product-manufacturing companies to change their position in the goods-services continuum by continuously extending the

service business dimension of their offer (Salonen, 2011; Kindstrom, 2010, Reinartz and Ulaga, 2008; Grönroos, 2007, 2006; Campbell-Kelly and Garcia-Swartz, 2007; Teboul, 2006; Oliva and Kallenberg, 2003; and Chesbrough and Rosenbloom, 2002). Salonen (2011) emphasized this, highlighting the challenge to move from a goods-based logic to a service-centred logic. According to Spring and Araújo (2009), however, what counts as a product or as a service relates more to the nature of producer-user interaction and the institutional structure of production and networks rather than to the attributes of products or services themselves. Tuli et al (2007) and Kapletia and Probert (2010) take this product-service discussion into the arena of solutions or integrated solutions (Davies et al, 2006; Windahl et al, 2004), which they see as a customized and integrated combination of goods and services for meeting a customer's business needs. Some demonstrate, however, that it is necessary to go beyond the dyads and focal networks perspective to incorporate a market-based approach to marketing solutions: "A solution situation is not a buyer-seller dyadic 'island'. It is multi-partite and not isolated from the 'rest' of the market" (Spencer and Cova, 2012, p.12).

Integrated solutions are offerings that require complex organizational responses and hence specific business models which demand further attention (Davies et al., 2006). In the opinion of Spring and Araújo (2009), the notion of business model is useful as an integrating concept, with focus on four areas: network structure, how transactions are made, how revenue models and incentives interact, and how capabilities are accessed. In this context, what are the features of the business models of firms involved in the provision of solutions? How are the business models of firms adapted for the provision of solutions over time? The aim of this paper, then, is to contribute to this discussion and to provide empirical evidence and theoretical development relative to the adjustment and external fit over time of business models in the solutions field. External fit is the appropriateness of a configuration given the environmental conditions a firm faces, whereas internal fit concerns the degree of internal coherence among a firm's elements (Siggelkow, 2002). From a solution perspective, the essence of the notion of environment is captured by the network concept and *milieu* (Cova et al., 1996), the focus of attention here.

This research is qualitative and exploratory in nature, developed using a case study approach (Byrne and Ragin, 2009; Ragin, 1992; Yin, 2003) as method to

investigate a contemporary phenomenon within its real life context and in which multiple sources of evidence are used. The paper presents a case study involving one of the leading aircraft manufacturers worldwide and its counterpart. Data were collected through multiple interviews with managers of the manufacturing firm and managers of a customer firm, an airline operating in the commercial sector.

The paper begins by presenting a theoretical review on the concepts of products and services in delivering benefits to customers. We discuss the recent conceptual evolution of services marketing literature, extending to the concept of offerings and solutions. We highlight the evolution of the concept from business solution to customer solution to market solution. The Business Model literature is then discussed in order to frame action and reveal connexions about how firms can offer solutions in business-to-business networks. The case is then described, providing empirical evidence of the interplay of products and services by manufacturing firms of complex engineering products, resulting in the development of market solutions. These findings are subsequently discussed.

3. 2 Transitioning from products to services to solutions

A recent trend of capital goods producing companies is to refocus from a “waiting for problems to emerge” approach or model, to a pro-active approach (Windahl et al, 2004). With this new approach, traditional structures and capabilities have to be transformed and continuously refined, and firms come to learn that the new model is all about systems integration and the provision of service. (Davies et al, 2006, p.40). The predominant view in the literature integrating a customized and integrated combination of goods and services for meeting a customer’s business needs is the concept of solution (Tuli et al, 2007; Kapletia and Probert, 2010; Araújo and Spring, 2006); Ford et al, 2003) or integrated solution (Davies et al, 2006; Windahl et al, 2004). Tuli et al (2007) argue that customers view a solution as a set of customer–supplier relational processes comprising: (1) customer requirements definition, (2) customization and integration of goods and/or services and (3) their deployment, and (4) post-deployment customer support, all of which are aimed at meeting customers’ business needs. The relational process view, thus, can help suppliers deliver more effective solutions at

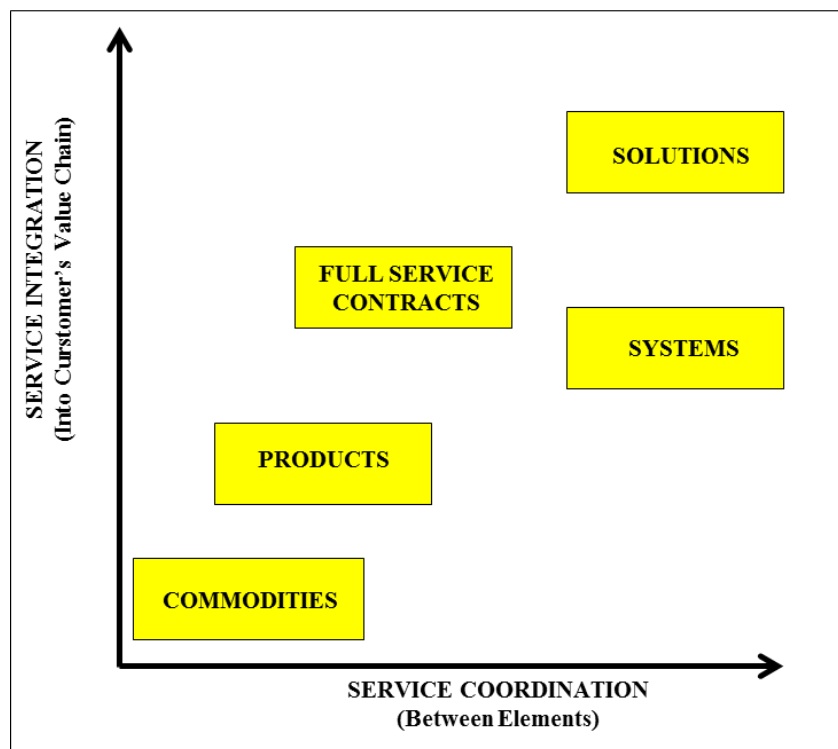
profitable prices. In addition, Tuli et al (2007) suggest that the effectiveness of a solution depends not only on supplier variables (contingent hierarchy, documentation emphasis, incentive externality, customer interaction stability, and process articulation), but also on several customer variables (adaptability to the supplier's offerings and political and operational counselling that a customer provides to a supplier).

Today, when we talk about solutions, the notions of service integration and coordination are critical. Business solutions refer essentially (Sawhney, 2006; Nordin and Kowalkowski, 2010) to an offering that incorporates a number of integrated services into the customer's value chain and that forms a non-dissociable whole. Indeed, business solutions represent the type of value proposition (Ceresale and Stone, 2004) which best marries improved integration into the value chain with increased coordination among the elements which go to make up the offering. The first point is related to the content of offerings and more particularly the service dimension of offerings. This point stresses the degree of integration of the offering within the customer's value chain (Storbacka, 2011). Customers expect a solution to include processes aimed at understanding their requirements, customizing and integrating products, deploying them, and supporting them on an ongoing basis (Oliva and Kallenberg, 2004; Tuli et al, 2007). The second point deals with the combination of the elements which make up these offerings. This point concerns more specifically the degree of coordination of these elements with each other, giving rise to a unique and indivisible solution (Davies et al, 2006; Stremersch and Tellis, 2002; Stremersch et al, 2001). For Gebauer et al (2013), the service components included in the solution drive the formation of the network along the vertical and horizontal dimensions. Gebauer et al (2013) identified four different types of service networks involved in the provision of solutions, and the capabilities necessary for forming and utilizing such networks. These are: a). vertical after-sales service network, b). horizontal outsourcing service network, c). vertical life-cycle service network, and d). horizontal integration service network. Analyzed through the perspective of the "focal firm", these network types promote understanding of the movement towards providing integrated solutions for products and services. The formation and utilization of each service network type require a specific set of dynamic capabilities (to initiate a specific network formation), and operational

capabilities (that allow the network firms to develop, integrate and deliver the service components of the solution).

Figure 3.1 shows how, when going from a commodities-based offering to a product-based one, then on to a systems offering and/or full service contract, and finally a solution offering, the suppliers have progressively increased both the degree of service

Figure 3.1: Degrees of Integration and Coordination of Offerings



Source: Author

integration in the customer's value chain, and the degree of coordination for the different service components included in the offering. This is in fact an evolution from goods-dominant to a service-dominant logic (Ng et al., 2012).

In a similar vein, Davies et al (2006) analyze how collaborating companies are changing wider organizational capabilities to provide integrated solutions, i.e, how the collaborating companies deliver integrated solutions in practice. For Davies et al (2006), firms have to demonstrate four key capabilities: systems integration, operational services, business consultancy and financial services. For the provision of these four

key capabilities, firms have to rethink organizational structure: comprising front-end customer-facing units, building modular offerings at the back-end and developing strong strategic centers, that allow adjudication between the front-end pull of customization and the back-end push for standardization. For Davies et al (2006), an integrated solution provider has “to move through three levels of organizational capabilities: at level 1, the company must build a new face to the customer; at Level 2, it needs to strengthen its back-end capabilities and, at Level 3, the organization – front and back – must be refocused around customer’s needs and around repeatable, integrated solutions delivery” (Davies et al, 2006, p.44).

Spring and Araújo (2013), consider there are multiple dimensions along which manufacturing firms might ‘shift to service’, and multiple logics as to which service offerings build most readily on existing and readily accessible resources. Selling products/services to customers, the manufacturer needs to develop relationships in its business network, considering relations with diverse suppliers. This happens when the parties perceive value in access to resources, skills and expertise in the development of relations (Spring and Araújo, 2013). As argued by Cantù et al. (2012, p. 139) for complex solutions, “each actor takes part in resources combination both as provider and user of resources... [and] shape the development of business relationships”. Taking things even further, Spencer and Cova (2012) point out that recent critical reviews of the literature are still anchored on the dyad and on the idea of customer solution, neglecting issues related to longer-term and broader-scope market dynamics. They argue and demonstrate that it is necessary to go beyond the dyads and focal networks perspective to incorporate a market-based approach to solutions marketing. In this sense, a solution can be understood as, in itself, a discourse on the market and its evolution, or in the words of Storbacka and Nenonen (2011), “market scripting”. Solution marketing is not simply a question of handling solutions for customers. It can be understood as a process of co-creation involving multiple actors, who indeed veritably shape, and are themselves in return shaped by, the markets and the networks that they engage in. For Storbacka and Nenonen (2011), the performative power of any market actor depends on its network position, its ability to author compelling meanings about the market and the relative strength of its business model. Business models thus

are not firm-specific concerns, but relate to fit of models between two actors, and indeed between multiple market actors.

3.3 Business models for solutions

The business challenge for most manufacturing firms is how to offer solutions generating a variety of revenue streams from both product and service transactions, as the recent literature on expanding the role of manufacturing suggests (Araújo and Spring, 2006). According to Bryson et al (2004, p.55), “manufacturing still matters, but manufacturing and services have become increasingly complementary and mutually supportive activities”. In this vein, Howells (2000, p.15) identified two different methods by which manufactured products are not offered alone to consumers but, rather, as part of a package that includes service components: a) manufactured products provided with closely aligned services, and b) the manufactured products supplied to consumers as a vehicle for accessing services, i.e. in cases where the product is not the end point of a transaction, but merely the beginning of the relationship between producer and customer. According to Howells (2000), these types of service/product relationships represent forms of what is termed ‘service encapsulation’, in which services are wrapped around or embedded in products and in which services can produce innovations in other sectors of the economy. For Bryson et al (2004), there are four different forms adopted by manufacturing companies when transforming themselves into either partial service companies or complete service companies: I) manufacturing-service companies; II) service-manufacturing companies; III) from manufacturing to service companies and IV) virtual production companies. A manufacturing-service company (I) is a firm that has begun to sell services that are linked to physical products. This is the first stage towards becoming a full service company. A service-manufacturing company (II) still produces products but the balance of their activities is shifting towards services. Through the process of servicing, product manufacturing companies can learn and develop new products or redesign. On the other hand, companies moving from manufacturing to service companies (III) used to produce or sell goods, but are no longer engaged in these activities. The company begins to sell knowledge-products but rapidly realise that the sale of such products is

more profitable than either producing or selling goods. Finally, a virtual production company (IV) is no longer directly engaged in the physical production of products. It has closed down or sold its manufacturing plants or, indeed, may never have been involved in the production process. Products are designed and marketed, but the production process is undertaken by service manufacturing companies that may not produce a product in their own right, but, instead, manufacture and even design products for other companies. For Spring and Araújo (2009), the process about moving from manufacturing to service company highlights the role of the literature on Business Models (Morris et al, 2005; Schweizer, 2005; Magretta, 2002) as a way to understand how firms can fit strategic, operational and economic decisions in order to offer solutions.

According to Magretta (2002), no consensus exists regarding the definition, nature, structure and development of the concept of business model. The concept includes such notions as structure, architecture, design, plan or method. Morris et al (2005) analysed 30 definitions of the term and identified three main categories of definition: economic, operational and strategic. The most rudimentary level involves defining business models solely in terms of a firm's economic model, focusing on generating profit (Stewart and Zhao, 2000). At an operational level, business models represent an architectural configuration and the focus is on internal processes and infrastructure design which enable firms to create value (Mayo and Brown, 1999). An understanding of business models on a strategic level, on the other hand, emphasizes overall direction in the firm's market positioning, interactions across organizational boundaries, and growth opportunities. According to Morris et al (2005, p. 727), business models can be understood in an integrative way: "a concise representation of how an interrelated set of decision variables in the areas of venture strategy, architecture and economics are addressed to create sustainable competitive advantage in defined markets". They go on to suggest it is possible to envisage a business model's life cycle involving periods of specification, refinement, adaptation, revision and reformulation. This idea of the dynamic nature of business models was raised by Schweizer (2005), for whom firms may face the pressing need to change and adapt their business models in order to maintain competitive advantage.

For authors such as Osterwalder and Pigneur (2005), Morris et al (2005), Schweizer (2005), Chesbrough and Rosenbloom (2002) and Magretta (2002) business models can be seen as a way to define and implement a process of value creation. However, Mason and Spring (2011), Nenonen and Storbacka (2010) and Spring and Araújo (2009) highlight the importance of understanding business models as the idea of value in a network. Value is considered to be co-created among various actors within the networked market and the idea of solutions or market solution, thus, calls for a view of business models that captures this. For Mason and Spring (2011, p.1035), in agreement with Nenonen and Storbacka (2010), “a ‘total solution’ market offering is valuable to customers depending in part on their ability to provide (or not) the solution for themselves”. This leads to the notion of core elements of business models: market offering, technology and network architecture (Mason and Spring, 2011) and network structure, how transactions are made, how revenue models and incentives interact and how capabilities are accessed (Spring and Araújo, 2009). For Mason and Spring (2011, p.1039), “the value of business models lies in their ability to frame action and reveal connexions between those actions, across multiple levels of analysis”. It is necessary to connect micro- to macro-level practices: from individual actions of front-line workers to the market level actions of networked organisations. Business models might be understood as bundles of interconnecting practices that evolve with the context within which they are practised – but that in turn influence and shape the context. In other words, business models relate both to market-wide phenomena, and are dynamic in nature. The business model framework is flexible in the sense that, being non-sequential, analysis can begin in any element or elements, depending on current concerns or opportunities. It also seems that there is considerable path dependence in the susceptibility of the various elements to innovation, as well as unanticipated dynamic interconnections between elements.

In the same vein, Nenonen and Storbacka (2010) also discuss about business models from a “value co-creation in the network” perspective, presenting a framework comprising 12 interrelated elements, with three types of components (design principles, resources and capabilities) that relate to four dimensions (market, offering, operations and management), as in table 3.1 below:

Table 3.1: Business model framework

	Design principles	Resources	Capabilities
Market	Market and customers definitions	Customers and brand	Market and customer management
Offering	Offering design and earnings logic	Technology	Offering management and R&D
Operations	Operations design	Infrastructure, suppliers and partners	Sourcing, production and delivery
Management	Management systems	Human and financial resources	Management and leadership

Source: Nenonen and Storbacka (2010, p. 50)

For Nenonen and Storbacka (2010), the business model framework consists of these 12 interrelated elements, i.e. design principles related to market, resources related to market, capabilities related to market, and so forth. Alongside this framework, Nenonen and Storbacka (2010) also suggest that various business model designs can create equally solid financial results, i.e, no specific business model design is superior per se. “There is no single best way to become a solutions integrator – and there is no guarantee of success” (Davies et al, 2006, p.47). Moreover, Nenonen and Storbacka (2010) propose that the effectiveness of a business model in value co-creation is defined by the internal configurational fit between all business model elements and the external configurational fit between provider’s and customers’ business models.

Mason and Spring (2011) put this proposal into perspective, however, by highlighting the need for sustained empirical study. The suggestion is that future research might focus on this, and also on generating insights into the proliferation of business models across business networks as technologies, market offerings and network architectures become shared, overlapping and interlinked. For the case of manufacturing firms offering services related to complex engineering products, these dimensions clearly call for greater clarification. The following sections, with this in mind, confront these theoretical issues with case data, taking into account products-service interplay as solutions, in an example from the aerospace industry.

3.4. Research Method

Considering the interplay between theory, method and empirical phenomena (Dubois and Gibbert, 2010), this article presents a case study analysis (Yin, 2003; Byrne

and Ragin, 2009; Ragin, 1992) so as to contribute to the discussion on the combination of products and services as solutions in business-to-business networks. The aim of the paper is to provide empirical evidence and to contribute to theory building in the area relative to business model dynamics and fit in a solutions business context. More specifically, taking as setting a manufacturing firm in the aerospace industry and its business network partnerships, the article sets out to identify dimensions for the business model developed around the “product-service interplay as solutions” offerings. As the business model of a manufacturing firm providing complex engineering products can only be understood from a network perspective (Mason and Spring, 2011), we took as focus for analysis interfaces between a world leading aircraft manufacturer and a customer firm, considering this dyad, however, as a part and a parcel of a network of actors that both *influences* and *is influenced by* this relationship. For reasons of confidentiality, the names of the companies and respondents have been disguised.

Desk research was performed initially, and coupled with interviews with managers of the two focal companies: managers from “EBR” (the aircraft manufacturer) and managers of “NATAIR” (the customer firm), using the scripts as presented in Appendix 1 and 2. Data collection took place via face-to-face meetings with managers, involving a total of 23 hours interviewing. Table 3.2 below identifies the interviewees and their work areas. A code was assigned to each to simplify presentation of results. For a better understanding of the structure and operations of the firms, a total of seven local site visits were carried out: 4 (four) at the aircraft manufacturer’s and 3 (three) at the customer firm. Secondary data sources, including such as articles and technical publications, provided a significant source of information, acting as backcloth to respondents’ comments and opinions. The data collected through in-depth interviews were then transcribed and analyzed using content analysis techniques (Krippendorff, 2004).

For the purposes of the investigation, the data targeted describes the relationships between EBR, as a manufacturing firm, and NATAIR, as a consumer of solutions, and highlights extended connections to other parties in the network that are needed for, and that influence, the development of solutions over time. Internal and

Table 3.2: Interviews and respondents' identities in this paper

CODE FOR INTERVIEWEES	INTERVIEWEE'S FUNCTION	INTERVIEWS/DURATION
EBR (AIRCRAFT MANUFACTURER)		
EBR 01	Technical Coordinator. Engineering Specialization Program.	1x 3 hours + 1x 2 hours of face-to-face interviews 1 x 30min telephone interview
EBR 02	Manager, Customer Support and Services Development.	1x 2 hours + 1x 2 hours of face-to-face interviews
EBR 03	Senior Manager, Systems Engineering	1x 2 hours face-to-face interview
EBR 04	MRO Services Engineer	1x 1 hour face-to-face interview
EBR 05	MRO Services Engineer	1x 1 hour face-to-face interview + 1 x 30min telephone interview
CUSTOMERS FIRMS		
NATAIR (Customer firm in commercial aviation)		
NATAIR 01	Chief Operating Officer	1x 1 hour face-to-face interview
NATAIR 02	Maintenance Director	1x 2 hours + 1 x 2 hours of face-to-face interviews
NATAIR 03	Maintenance Planning Manager	1x 3 hour face-to-face interview + 1 x 30min telephone interview
NATAIR 04	Technical Coordinator	1x 1 hour face-to-face interview
NATAIR 05	Technical Engineer	1x 1 hour face-to-face interview + 1 x 30min telephone interview

Source: Author

external dimensions (Mason and Spring, 2011; Nenonen and Storbacka, 2010) of business models for these relationships are described in order to provide evidence about how product-service combinations as solutions are provided and evolve across business networks. Relationships involving EBR and NATAIR are described in order to frame action and reveal connections about how manufacturing firms manage the interplay between products and services as solutions with customers (Kapletia and Probert, 2010).

3.5. The “EBR-NATAIR” case

EBR is a company with more than 40 years of experience in designing, manufacturing, selling and supporting aircraft for the global airline, defence and business aviation markets. It was founded as a government initiative and then privatized. Since then, EBR has developed its activities in order to compete in a global market, addressing three specific market segments: commercial, defence and executive aviation. For each segment, EBR produces specific airplanes and, in order to support its

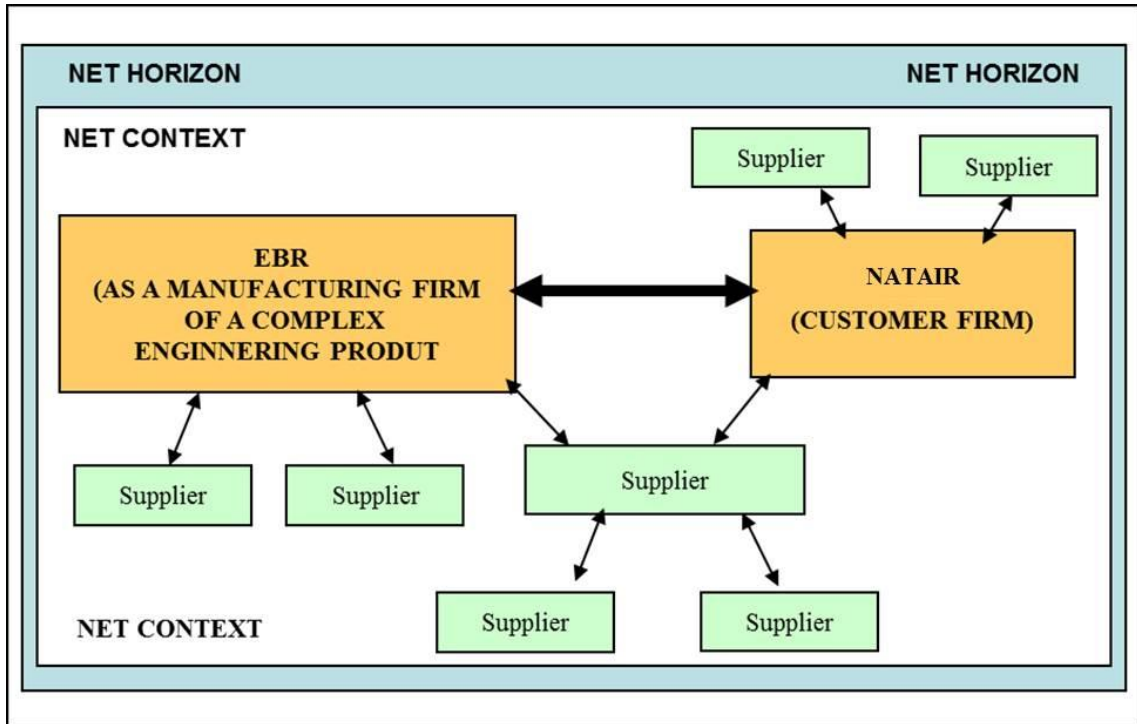
customers and provide after-sales services, EBR has developed a portfolio of Aviation Services which encompasses aircraft maintenance, spare parts supply, training and aeronautical systems. The Aviation Services unit is divided into different activities: Field Support, Technical Support, Maintenance Engineering, Operational Support, Maintenance Services, Material Support, Technical Publications and Training.

EBR serves these markets via headquarters, on the one hand, and offices, subsidiaries and customer service facilities around the world on the other. Foreign units perform warehousing, sales, logistics and repair management of aircraft parts and technical and operational support. In order to carry out design, manufacture, sales and aircraft support for global airline companies, EBR has developed procedures and interactions between its own service units as well as with customers, suppliers and partners. We analysed interfaces between EBR (as a manufacturing firm), NATAIR (an airline, customer), whilst identifying extended connections to other parties in the network, contributing to the development of solutions over time.

On the customer side, NATAIR can be described as a young company, and a major national airline, totalling 14% of its domestic market. NATAIR's business model focuses on stimulating traffic and boosting the national economy through a formula combining low prices and high quality services. For this, NATAIR has developed strategic routes connecting medium-sized and small cities, via secondary airports. For these flights, NATAIR uses aircraft from the EBR commercial fleet. Within the framework of their relationship, EBR and NATAIR have developed, since 2008, an interactive interface (Araújo et al, 1999). For the supply of an aircraft to NATAIR, EBR has also developed an interactive interface with many suppliers, involving supplies of engines, spare parts, training etc., as illustrated in figure 3.2 below.

Relationships developed between these companies represent interactions, involving adaptations, and exchange of resources and capabilities. Thus, at EBR, there is a network that has been developed and indeed nurtured, which includes customers and partners, but also other types of actors including suppliers, the "suppliers of the suppliers" etc. In addition to the network that is built around the supply of products (tangible goods), co-exists a network related to service provision (for maintenance and repair services, training, technical support, development of new services etc.).

Figure 3.2: Interactions and service/complex engineering product interplay



Source: Author

The analysis from interview data allowed identification of two categories of service provision: firstly, to support the aircraft, and subsequently for its improvement over time. Both product and service networks exist in a combined, intertwined way, ensuring the provision of value propositions not just to the customer but to all members of the network:

An aircraft is a high performance product that has to meet customer needs as regards comfort, range, and speed. The services also have to answer these needs. Sometimes support services come as an expanded product. Services typically require dedicated staff, global presence, and a broad and competitive portfolio (interviewee EBR 02).

The relationship developed between EBR and NATAIR can be better understood by the consideration of the different phases structuring a multipartite partnership: a pre-contract phase (Model Choice and Commitment) and three subsequent post-contract phases (Joint Definition; Manufacturing; Delivery/Operation). Each phase can be seen to demonstrate different issues relating to value and value co-creation over time, by

different types of services provision. The aircraft purchase process usually initially comprises a comparison of costs and benefits. According to interviewees “NATAIR01” and “NATAIR 02”, at this time, both the aircraft (as goods) as well as the supplier’s overall ability to provide services throughout the life cycle of the system being offered are subject to analysis. The structure of the system supplier’s supplier portfolio is thus also a critical issue, i.e. relationships between a supplier and its subsystem suppliers. Once the aircraft is in operation, however, customers can still access services in different ways: EBR aviation services, in-house services (i.e, when the customer decides to provide the service by itself) or independent service providers. Each type of contract between the supplier of the aircraft and the airline can include, or not, associated services. Generally, support services are already offered in conjunction with the aircraft. Other specific services can be negotiated separately. When acquiring an EBR aircraft, the customer has a multitude of different kinds of additional tailor-made services that can also be developed in the framework of the collaboration, by a dedicated team, providing further added value.

Competitive advantage for EBR comes, then, from the capability of the company to offer support services, but also to deal with differentiated services. According to interviewee “EBR 05”, “we offer a product that is a solution. It depends on the market”. This idea also reflects the customer’s perception, as expressed by an NATAIR respondent:

EBR sells a package. We bought the aircraft along with a range of services. For example, the rental asset management programs helped NATAIR’s cash flow, especially at the start-up stage of operations. The use of these asset management programs avoids immobilization of capital in various aircraft components and reduces logistics and spare parts costs (respondent NATAIR 02).

According to respondent “EBR 01”, “the development of an aircraft is customer-oriented”. When the customer needs adaptation, exchange of skills and competences (as service processes) is called for. This exchange of skills, competences and know-how between EBR and suppliers is critical to the delivery of the aircraft with the necessary

adjustments. In this respect, both EBR and NATAIR managers underscored the importance of continuous interaction between all parties involved:

We have regular meetings with key suppliers and customers. This occurs at regional or global levels, depending on the location of customers. We always seek to develop win-win relationships with our customers. (respondent EBR 03)

Reliability data is made available to customers in order to help them meet the requirements of their Reliability Programs. There are monthly reliability meetings that take place with people of all parties (NATAIR, EBR and key suppliers). These meeting are important to develop the product and improve system performance. (respondent NATAIR 02)

The provision of solutions in the EBR - NATAIR case can thus best be understood through a network perspective. Figure 3.3 below summarizes actors directly and indirectly involved at each stage of the relationship developed around the provision of products/services as solutions over time. As summarized in Figure 3.3, the development of an aircraft can take from one to five years. In the relationship start-up phase, an analysis of available technologies and competition with the customer allows decisions to be made as to what should be developed internally (EBR), shared and conjointly developed (with the key engine supplier, for instance), or sourced from the market (commodities). Integrated and proactive approaches between actors lead to frequent updates of the value proposition over time before the delivery of the final aircraft. The useful life of an aircraft is approximately 20 years. This means that it is not just a question of integrated and proactive approaches leading to aircraft sales on a transaction basis. EBR offers continuous technology upgrades to NATAIR over time. As confirmed by respondent EBR 03: “Over the life time of the aircraft, our interfacing with customer is broad and continuous. An aircraft is a product that is alive!” and “To be able to meet up with NATAIR’s evolving needs has meant frequent exchanges not just between us and NATAIR but joint meetings and exchanges with the supplier of the engine, for instance”. EBR, to be competitive, needs to find suppliers as partners, willing and capable of doing this. “For some projects, we have a supplier team here, on the spot,

working together with us. This is done when we need to develop something jointly” (EBR 05).

Figure 3.3: Time, network actors and the provision of solutions in the EBR - NATAIR case

DIMENSIONS	RELATIONSHIP'S STAGES OF EVOLUTION			
	DESIGN AND COMMITMENT	JOINT DEFINITION PHASE	MANUFACTURING	DELIVERY/ AIRLINE OPERATION
ACTORS DIRECTLY INVOLVED	EBR and AARL	EBR, AARL and suppliers of components or parts (ex: suppliers of engine)	EBR, AARL and suppliers of all components and parts and service providers (ex: training)	EBR, AARL and engine suppliers, suppliers of components or parts and service providers related to the performance/improvement of the aircraft over time (ex: maintenance and repair, on board entertainment services etc.)
OTHER NETWORK ACTORS	Financial entities; Government; Competitors; Other customers	Financial entities; Government; Competitors; Other customers	Financial entities; Government; Competitors; Other customers Supplier's of suppliers	Financial entities; Government; Competitors; Other customers Supplier's of suppliers etc
SYSTEM INTEGRATION HANDLING	- Initializing and stabilizing of dyadic interaction framework - Total cost of ownership (TCO) Assessment - Identification of needs - Selection of partners	- Formation of integrated teams - Joint definition of the aircraft configuration - Selection of partners	- Monitoring of competitors' moves/new technologies - Management of power balance in the relation among firms	- Increased integration (physical, data sharing, website...) - Continuous technological upgrading of post-sales offering
EVIDENCES OF MARKET SHAPING SOLUTIONS	- Provisional system integration (by EBR) and initial offering/needs fit	- Advanced design integration and adaptation to requirements	- Continuous design innovation and adaptation to environmental shift prior to delivery	- Post-delivery system problem solving and technology upgrades
DURATION	Variable	Up to one year	From one to five years	Aircraft life cycle (20 to 25 years)

Source: author

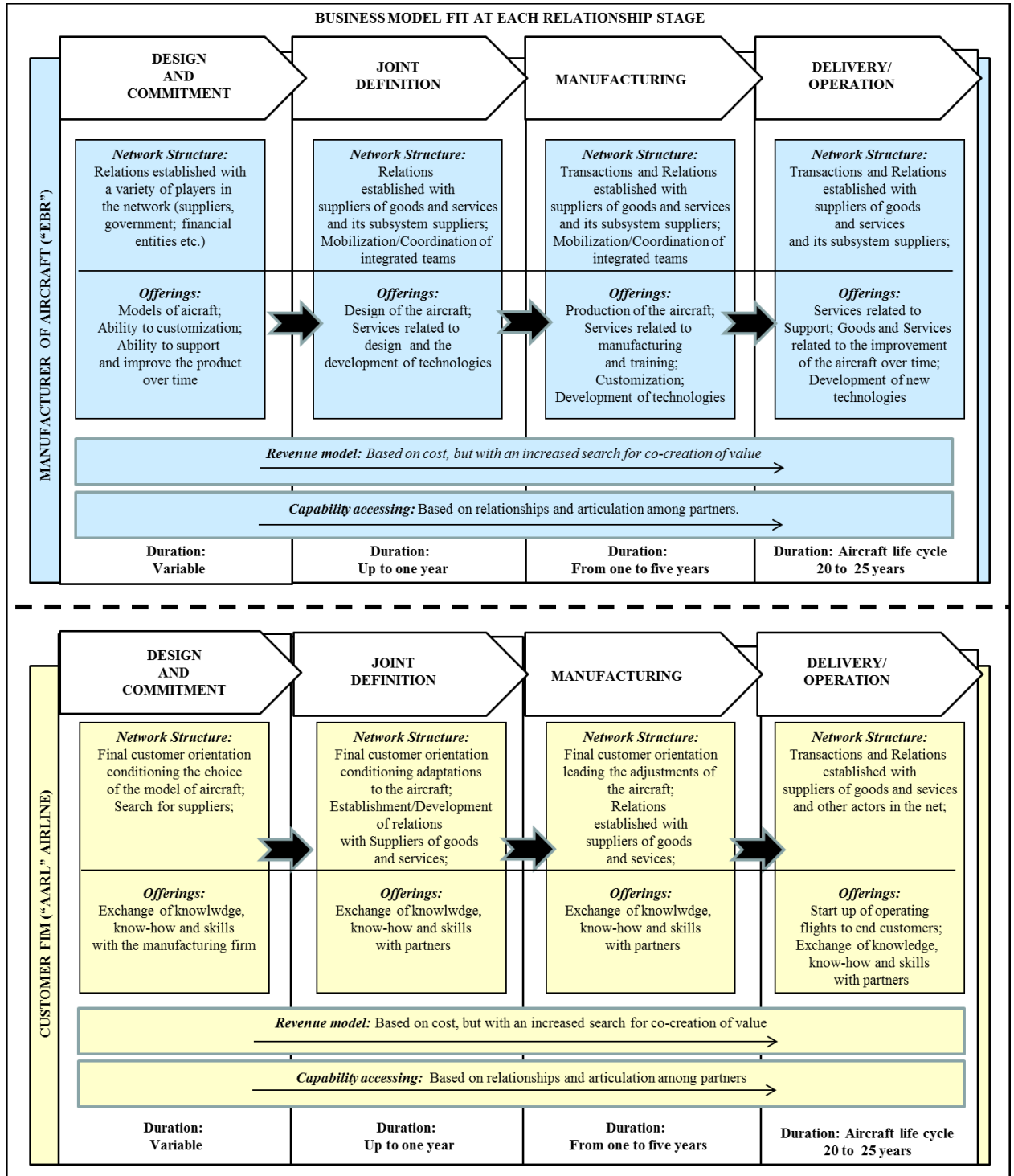
The data and summary diagram above provide evidence of a manufacturing firm enacting, via a network context, a subtle, varied and ever-changing interplay of products and services, in this case over the life-time of the product and beyond. This enables co-creation of solutions with customers, suppliers and other actors in the market, going beyond the dyad, for the benefit of multiple network actors. For this, EBR presents a business model that can be described as being: customer oriented;

relationship based; access-based; solution provider (portfolio of goods and services); and development of technologies for differentiation and adaptability (evolution over time). Similarly, as a partner interested in a long-term relationship, NATAIR also develops a corresponding resource accessing and network-based business model. NATAIR is also a firm interested in the development of technologies for differentiation, and interacts with EBR and other actors in the network, demonstrating adaptability and flexibility in order to develop solutions over time. Whilst co-creating solutions, both firms, as parties to a network, are at the same time both shaping the market and being influenced by it. External factors, relating to the dynamics of each and every actor in the net; the types of interaction developed; the accessibility and accessing of resources and capabilities and sources of competitive advantage continuously influence the relationship between the supplier and customer. The influence of external factors is considerable, from an evolutionary perspective.

Indeed, the analysis of the interview data reveals firstly not one but several versions of business models for a same firm, supplier and buyer side, which are adapted over time to fit the different relationship stages. Figure 3.4 below presents a summary of the most important adjustments to EBR's and NATAIR's business models over time. In order to show details since the initial stages of the relation between EBR and NATAIR, figure 3.4 focuses on the first purchase process of a fleet and the evolution of the relationship at each stage. In line with the proposals by Spring and Araújo (2009), then, we observed that, in the case at hand, it is the Network Structure and Offerings dimensions of the business models that demonstrate the most important changes over time.

EBR, as a manufacturer of complex engineering products, needs to develop relationships in its business network over time, including relations with actors such as suppliers of goods and services, financial entities, and government. Depending on the stage of the relationship with NATAIR, however, different offerings need to be provided by EBR, calling for adaptation to the network structure. In the of Design and Commitment stage (Pre-contract), EBR needs to demonstrate to NATAIR its ability to produce and to support the aircraft throughout its long life. For this, EBR needs to demonstrate that it can access capabilities by relationships with partners.

Figure 3.4: EBR and NATAIR's Business Models fit for the provision of solutions



Source: author

In Post-contract stages, EBR needs to mobilize partners and develop relationships but, frequently, to act also as a coordinator in integrated relations involving a variety of

partners. For five years, in the Joint Definition and Manufacturing stages, the offering is related more to design and manufacturing. After the delivery of the aircraft, though, i.e. over 20 to 25 years, the operations stage requires of EBR an offering based on the support and improvement of the fleet, so as to provide NATAIR with innovative solutions over time. Thus, for both firms, given that the aircraft is a long-life complex product, revenue models are developed based initially on cost and the search for value creation then, as relationships evolve, an increased search for the co-creation of value can be observed. Figure 3.4 provides details on the initial stages of the relationship between EBR and NATAIR, with emphasis on a new buy situation i.e. the first purchase process of a fleet by NATAIR. If, however, a rebuy situation between EBR and NATAIR were taken, similar stages can be expected, but with probable adjustment of the business models as compared to a new buy situation (i.e. the duration of initial stages, and – for value co-creation purposes - the content of business model dimensions may be different, depending on the model of the new aircraft or fleet).

3.6. Business model configurations and fit for the provision of solutions

The EBR-NATAIR case provides empirical evidence of a manufacturing firm's business model dynamics, involving product-service interplay, to provide solutions. In line with "service encapsulation" thinking (Howells, 2000), EBR can be seen as a company providing manufactured products with closely aligned services or as a "service-manufacturing company" (Bryson et al., 2004): EBR produces products but the balance of its activities is shifting towards services. However, what we see is not a manufacturing firm becoming progressively and once and for all a service provider. Rather it is a question of specific bundlings of the product-service dimensions over time relative to relationship and market context, and corresponding management of interfaces and interaction within and between relationships and networks. As a manufacturer, EBR's offers comprise service activities to develop and to support its products, but at the same time and especially mobilises its relationships with customers and others in its network. EBR thus has a core business model open to adaptations and evolution depending on context thanks to/due to the flexibility of internal and external configurations not only supplier and buyer-side, but also market wide.

The case also demonstrates how two companies - the manufacturer/provider EBR and the customer NATAIR - shift form and content of their respective business models all along the phases of the relationship to adapt both to the needs of the counterpart and to market context. The ingredients of EBR's business model change across different stages of the transaction and over the life of the relationship with the customer (aircraft purchase stage, post-purchase, etc.). Building on the notion of "external fit" (Siggelkow, 2002), the case shows how EBR continuously develops and adapts – from a mutual and reciprocal value-creation perspective - a series of interactions in the network comprising its own service units as well as customers, suppliers and other partners for the design, manufacture, sale and support of aircraft. Indeed, this mobilized network is an integral part of the business model.

The external fit of business models addresses the appropriateness of the configuration given external environmental conditions. As environmental conditions change, the business models may require adaptation or wholesale change. This happens at the level of the customer-supplier dyad: when one firm changes business model, the other changes too. The external fit of EBR's business model concerns, in fact, not simply the relationship with the customer but the network as proposed in the business model framework of Mason and Spring (2011). The case analysis demonstrates that EBR's solution approach stems from the nature of the producer-user interaction, i.e, it is the interaction interface discussion that is the focus for attention, not the nature of the object of the exchange (Araújo and Spring, 2006). Indeed, a business model based on relationships is proposed by both firms (Oliva and Kallenberg, 2003), with the need for fit and possible adjustment over time to ensure this fit. Design principles, resources and capabilities related to market, offering, operations and management involving the EBR-NATAIR relationship provides some evidence of how EBR develops its business model in order to satisfy customers' needs. But, especially and most importantly, beyond the provider-customer relationship business model fit, the provision of solutions of EBR to NATAIR over time depends on and conditions the dynamics and fit between other relationships and partnerships that EBR establishes with many other parties in the network. Relationships developed with suppliers and other counterparts such as the qualified service centers, and the supplier's suppliers illustrate that solutions can be understood as a market shaping process (Spencer and Cova, 2012), hence the necessity

to explicitly include this dimension into the business model. Indeed, the business model of EBR co-creating solutions with NATAIR can only be understood by taking into account the linkages between internal and external configurations (Nenonen and Storbacka, 2010).

3.7. Conclusions

This article focuses on external configurational fit – and specifically evolution over time - between provider's and customers' business models in a network and broader market context. The case study confirms the suggestion that focus for the business model fit should not be the product or service, but rather the interaction and relationships between all parties present. It responds to the plea for empirically based work on business models by Mason and Spring (2011). The paper highlights the fact that a business model in a solution context is not firm-focused, nor dyad-focused. It is rather a question of interactive business models and thus relationship and network-focused. The very long time frame (more than 20 years in the Aerospace industry) of solution business obliges all actors to continually and mutually reconfigure their activities. The search for fit is one issue, but this fit – given the time scale involved – can potentially lead to increased dependency and loss of autonomy. Indeed, a solution business model is a shared and a sharing process with collective emphasis (Cantù et al., 2012). This claim argues for promising future research relating to the notion of market-shaping (Araújo et al., 2008) and the need to address business models from a market-centric (Spencer and Cova, 2012) approach. Market shaping processes in the case of solutions are reciprocal: the solution processes influence the shape of the market, whilst at the same time being influenced by forces at play in the market. An evolution of the business model adopted by the two key actors in the solution provision process central in the case (see fig. 3) here will impact the business models of service providers and of suppliers of parts and components, and this over a long period of time. The result is an intricate real-time intertwining of business models between all actors directly involved in the solution network. This can be likened to an immense multi-dimensional jigsaw puzzle where both the shapes of the pieces shift over time, as do the interconnections between them, with consequences for the overall picture of the market itself.

Managerial implications for companies transitioning from products to services to solutions include the key idea that business models for solutions have to be based on relationships. In a solution approach, both the degree of service integration in the customer's value chain, and the degree of coordination for the different product/service components included in the offering are very high. For the solution provider this means placing at the core of the business model not only relationships with the customer, but also relationships with suppliers of parts and components and/or service providers in a triadic fashion (Choi and Wu, 2009a,b). Indeed, the triad solution provider-customer-supplier(s) (see Fig 2) could be considered the fundamental building block of the solution business model. With this in mind, the solution provider has to construct its business model as ever-evolving in order to maintain the external fit with its customers and its suppliers. External fit seen from this perspective is not a unidirectional fit (the supplier's model relative to its environment) but rather reciprocal fit between multiple actors involved in the solution process. This reciprocal fit as demonstrated is subject to constant shift over time. Adopting a business model requires a subtle mix of optimizing on fit while anticipating on need for autonomy to capture new opportunities.

Chapter 4

A PHASE MODEL FOR SOLUTION RELATIONSHIP DEVELOPMENT: A CASE STUDY IN THE AEROSPACE INDUSTRY

RESEARCH HIGHLIGHTS

- The provision of solutions is a multiple and varying process and not a single linear process.
- In the provision of solutions, different phases can be identified as relationships evolve.
- The intensification of business processes takes place through observing the business opportunities that exist in the interactions between parties.
- Firms continuously try to find better ways of co-creating value and may or may not intensify the relationships.
- The provision of solutions is not a stable but a dynamic process according to the evolution of the relations among firms.

This paper was presented as a competitive paper and published in the Proceedings of the Industrial Marketing and Purchasing Group Conference, Bourdeaux, France, 2014, with the title “Network dynamics in solution business: stages of relationship among firms”. It is also in the third round of blind reviews in an ISI - Web of Knowledge Journal.

CHAPTER 4- A PHASE MODEL FOR SOLUTION RELATIONSHIP DEVELOPMENT: A CASE STUDY IN THE AEROSPACE INDUSTRY

Abstract

The evolution of the business-to-business (BtoB) realm towards solution business calls for a better understanding of how relationships develop over time in such a renewed context. This paper proposes a phase model for solution relationship development, considering triadic relationships in complex engineering solutions. Extending conventional dyadic analysis, this empirical study focuses on the aerospace industry using a case study approach to analyse a worldwide leading aircraft manufacturer, one of its customer and four providers of products and services. We adopt a triadic perspective in the selection of cases, considering a total of four manufacturer-provider-customer triads. Four dynamic phases which track solution provision dynamics and involving dyadic and triadic relationship evolution are identified: Matching; Combining; Mixing; Sharing. This paper contributes to the gap about solution relationship development. Considering the lens of a triadic approach, the paper also helps to fill the as yet unattended to gap between dyads and triads in the literature.

Keywords: Aerospace; Business Relationship; Complex Engineering System; Solution; Triad.

Introduction

The development of relational approaches in BtoB marketing during the 80's has fostered the study of business relationships (Håkansson, 1982). Benefits to companies from developing relationships with customers, suppliers and other network counterparts have been emphasized (Håkansson and Snehota, 1995). The topic of buyer-seller relationship development over time has been under particular scrutiny; research has directed attention to the dyadic process of power and bargaining between two actors.

Ford (1980) introduced a development model that suggests that a relationship also follows five stages. Dwyer *et al.* (1987) described this development of the relationship as passing through five stages, going from awareness through to dissolution. Thus the development of supplier-customer relationships traditionally can be seen as an evolutionary process. Much focus has been placed on the relationship start-up and development stages. More recently authors (Havila and Salmi, 2008) have focussed on the relationship termination stage considered as being of particular interest.

Since that time, BtoB relationships and the study of these have undergone a major upheaval with the emergence of so-called solution selling or solution marketing approaches (Sawhney 2006; Tuli *et al.*, 2007). The last few decades have seen a transition in business offerings from products to services to solutions (Salonen, 2011) and a conceptual shift from consideration of dyadic relationships to that of networks (Håkansson and Snehota, 1995). Indeed, today, “across industries and markets, firms marketing products and services are increasingly offering solutions” (Nordin and Kowalkowski, 2010, p. 441). The evolution of the BtoB realm towards solution business consequently calls for a better understanding of how relationships develop over time in such a renewed context as the former dyadic models of supplier-customer relationships do not seem to enable us to grasp the complexity of multiple solution relationships (Raddats and Burton, 2014; Vargo, 2009). This paper contributes to the field of solution relationship development. Combining the emerging body of literature on solutions and established frameworks within the business relationship literature, one key question emerges: How do business relationships develop among firms interacting for the provision of solutions? Subjacent questions relate to: Can phases be identified in the relationships among firms providing solutions? Can different combinations of business actors be identified over time?

In this respect, we consider that, in the case of integrated solutions, the key - and more pertinent - unit of analysis is not relationships within a dyad but within a triad (Havila *et al.*, 2004; Van der Valk and Van Iwaarden, 2011). Indeed, the customer co-creates the solution with its supplier, who outsources a part of the system to a specialist provider who is also in direct contact with the customer. We expect, then, that a model of triadic relationship development provides better answers to the questions posed above. This paper proposes a phase model for the development of relationships among

firms interacting in the provision of solutions. A qualitative and exploratory research method is adopted using a case study approach involving one of the leading aircraft manufacturers worldwide (named here EBR), one of its airline customers (named here NATAIR) and their counterparts. The case study can be seen both as a single and a multiple case study, as the encompassing case of the integrator – EBR - serves as umbrella for the triad-specific cases (Yin, 2003). Four triads are identified demonstrating thus a relevant range of different situations. The unit of analysis is the triadic interface between firms (supplier/aircraft manufacturer/customer) in the aerospace industry.

The first section of the paper presents a chronological overview of relevant research on business solutions in order to highlight the complexity of relationships between firms in this context. This overview demonstrates the clear theoretical gap regarding the development of business relationships in a solution context. The research project based on a case study is detailed. The results of the case study are then presented and collectively discussed in relation to the preliminary findings. A content analysis of the case is then undertaken adopting a phase model perspective. In this way, the paper contributes to the discussion about how relationships are developed in the provision of complex engineering solutions.

4.2. From products to services to solutions

Traditional product-manufacturing companies are brought to change their position in the goods–services continuum by continuously extending the service business in their offers (Gebauer, 2008; Oliva and Kallenberg, 2003) and thus providing solutions. In the marketing literature, solutions are seen as integrated combinations of products and services aiming to solve customer's problem (Storbacka, 2011; Tuli *et al.*, 2007). More precisely, solutions refer to an offering that incorporates a number of integrated products and services into the customer's value chain and that forms a non-dissociable whole (Nordin and Kowalkowski, 2010). Solutions represent the type of value proposition which best marries the evolution towards improved integration into the value chain and increased coordination among the elements which go to make up the offering. The first point is related to the content of offerings and more particularly the

service dimension of offerings. This point stresses the degree of integration of the offering within the customer's value chain. Customers expect a solution to include processes directed at understanding their requirements, customizing and integrating products, deploying them, and supporting them on an ongoing basis (Oliva and Kallenberg, 2003; Tuli *et al.*, 2007). The latter point deals with the combination of the elements which make up these offerings. This point concerns more specifically the degree of coordination of these elements with each other, giving rise to a unique and non-dissociable whole (Davies *et al.*, 2007).

Focusing on the dyad, Kapletia and Probert's (2010) research suggests that the effectiveness of a solution or a "solutioning system" depends not only on supplier variables but also on several customer variables. Davies *et al.* (2007, p. 185) going beyond the dyad consider that "a prime contractor organization [is] responsible for the overall system design and integrating product and service components supplied by a variety of external suppliers into a functioning system". Storbacka *et al.* (2013), taking the discussion on dyads towards the network level, identify four continua that are of specific relevance for industrial firms transforming toward solution business models: customer embeddedness, offering integratedness, operational adaptiveness, and organizational networkedness. Related to organizational networkedness, works by Helander and Möller (2007) and Cova and Salle (2008a) place the emphasis on the fact that solutions can only be understood via consideration of network mobilization. Helander and Möller (2007) affirm that a system supplier's customer strategy is closely related to its roles for the customer. The key activities are described as links between supplier and customer, and the coordination mechanisms are presented as a horizontal continuum across activity links. Moreover, both suppliers and customers may actively use the resources and capabilities of third parties, called "network". The solution provider often needs partners for creating and maintaining the system. According to Helander and Möller (2007), the partner network enables the supplier to focus on activities which are both difficult to standardize and require highly specialized expertise, for instance application and business consulting. "The consistent performance for the customer seems to require from the supplier excellent network management capabilities, both at corporate and account team level" (Helander and Möller, 2007, p. 725). Cova and Salle (2008a,b) contend that creating superior value for customers means

mobilizing and servicing actors far beyond the boundaries of the buying center, supply chain, and customer solution net. Drawing on their experience of project marketing, they demonstrate the importance of suppliers combining both upstream and downstream approaches when developing a solution. Through an upstream approach, the supplier identifies all the actors in the customer network that could be involved in the customer's decision-making process and attempt to understand what is at stake. Through a downstream approach, the supplier designs the content and the perimeter of an offer in such a way as to customize it according to what is at stake for these customer network actors.

All in all, these network approaches tend to resemble constellations of actors (Normann and Ramirez, 1993) around and influencing the buyer-supplier dyad (Ferreira et al, 2013; Spencer and Cova, 2012). This calls for a broader perspective of business relationship development going beyond a dyad-centric view.

4.3. Relational development and solutions

According to Dwyer *et al.* (1987), each phase of their dyadic relationship development process, represents a major transition in how parties consider one another and can be understood as: 1) awareness, 2) exploration; 3) expansion; 4) commitment and 5) dissolution. Ford (1980) characterizes the process of establishment and development of supplier-customer relationships over time based on the variables of experience, uncertainty, distance, suggesting that such relationships follow a five-stage evolution process: pre-relationship stage; the early stage; the development stage; the long-term stage; and the final stage/break-up. The dynamics of the relationship development process of dyads described above can provide some clues as to the understanding of the dynamics in solution business relationships. Sawhney (2006) and Tuli *et al.* (2007) however, considering the complexity of relationships between firms engaged in the provision of solution, bring specific contributions to the field. Examining solution, Tuli *et al.* (2007, p. 5) describe solution transactions as “an ongoing, relational process of defining, meeting, and supporting a customer's evolving needs” characterized by “a set of four relational processes” that are: 1) Requirement definition: customers are not fully aware of their business needs and need to have discussions with

the supplier to elaborate them; 2) Customization and integration: customization involves designing, modifying, or selecting products and services to fit a customer's environment and integrating them into a coherent whole; 3) Deployment: deployment refers to the delivery of the integrated solution and its installation within a customer's environment; 4) Post-deployment support: post-deployment support is more than providing spare parts, operating information, and routine maintenance. It also involves deploying new solutions in response to customers' evolving requirements. Sawhney (2006) also identifies the customer activity cycle as the temporally linked sequence of activities in which customers engage to solve a complex problem. This cycle consists of three phases (Sawhney, 2006, p. 372): 1) Pre or before: when customers are deciding what to do to get the desired result – searching, deciding, acquiring; 2) During: when customers are doing what they decided on – installing, using, operating; 3) Post or after: when customers are keeping things going – reviewing, renewing, extending, upgrading' and updating. Taking together the ideas of these authors, we can see that all of them consider that the dyadic process of solution relationships develops through four general stages plus a possible stage of dissolution (Table 4.1):

Table 4.1. A literature analysis of the development of dyadic business relationships

GENERAL STAGES IDENTIFIED	PHASES FOR DYADIC RELATIONSHIPS
BEFORE ESTABLISHING THE RELATION	<ul style="list-style-type: none"> • Awareness (Dwyer <i>et al.</i>, 1987) • Pre-relationship stage (Ford, 1980); • Requirement definition (Tuli <i>et al.</i>, 2007) • Pre or before (Sawhney, 2006)
INITIAL RELATION	<ul style="list-style-type: none"> • Exploration (Dwyer <i>et al.</i>, 1987) • Early stage (Ford, 1980); • Customization and integration (Tuli <i>et al.</i>, 2007) • During (Sawhney, 2006)
DEVELOPING THE RELATION	<ul style="list-style-type: none"> • Expansion (Dwyer <i>et al.</i>, 1987) • Development stage (Ford, 1980); • Deployment (Tuli <i>et al.</i>, 2007) • During (Sawhney, 2006)
IMPROVING THE RELATION	<ul style="list-style-type: none"> • Commitment (Dwyer <i>et al.</i>, 1987) • Long-term stage (Ford, 1980); • Post-deployment support (Tuli <i>et al.</i>, 2007) • Post or after (Sawhney, 2006)
DISSOLVING THE RELATION	<ul style="list-style-type: none"> • Dissolution (Dwyer <i>et al.</i>, 1987) • Final stage/rupture (Ford, 1980)

Source: Author

These models represent a valuable contribution to the understanding of solutions. They are however dyadic in nature – the customer on the one hand, and the supplier on the other - and short-term, being essentially transaction-based, they do not offer us a full solution relationship development framework. Tuli *et al.* (2007, p. 14) emphasize that when solution customers interact with multiple suppliers, it is important “...to develop relationships not only with a customer but also with other suppliers... These conjectures require further investigation”. This is a strong hint towards the need to study how triadic relationships develop over time. Indeed, one way of handling the complexity of solutions is to consider triads. Choi and Wu (2009a,b) posit that triads are the fundamental building blocks of a network. In the case of integrated solutions, this means taking into consideration the triad in which the customer co-creates the solution with its supplier, which outsources a part of the solution (a subsystem) to a specialist provider, also in direct contact with the customer. A triad is substantially different from a supply chain in two important ways: 1) in terms of flows; and 2) in terms of who has power (Van der Valk and Van Iwaarden, 2011). Peng *et al.* (2010) point out that neither the strategic management literature nor the operations management literature address the triadic level in strategic network and supply network research. Peng *et al.* (2010) show that the changing structure of triads between the pre-contract and post-contract stages leads to stronger links between subsystem provider and customer. They consider however the issue at transaction level and not at relationship level.

Kaelen (2014), in response to the call for a focus on triads, examine the aerospace industry and propose a conceptual model involving what they term the “MRO&U triad”. This triad is formed by the OEM (original equipment manufacturer), the maintenance supplier, and the operator, i.e., in more general terms, the supplier, the service provider and the buyer. Each of these entities contributes to the performance of the “product” and contributes to improve performance in the MRO&U triad. Overall this research supports the view, then, that in the case of integrated solutions a key unit of analysis is not the dyad but the triad (Havila et al., 2004; Van der Valk and Van Iwaarden, 2011). Rather than passing through consecutive dyadic relationships in a supply chain, subsystem suppliers participate directly and simultaneously, in a tri-partite manner in a value co-creation process with the solution supplier and the customer.

4.4 The Research

This paper draws upon the emerging body of literature on solutions and focuses on the theoretical gap that exist in considering this concept related to established business relationship literature. In order to contribute with this field, the paper aims to propose a phase model for solution relationship development, considering triadic relationships in complex engineering solutions. Empirical data is collected taking the aerospace industry as the context for a case study. Case study research (Yin, 2003; Byrne and Ragin, 2009) investigates contemporary phenomena within their real life contexts using multiple sources of evidence. Specifically, the method is based on the study of one or more cases on a given phenomenon to acquire improved understanding or general conclusions on the topic under study. Some authors have argued that a single case study is justified or even preferable under certain conditions (Easton, 2003; Siggelkow, 2007). However, for theory building purposes, the use of multiple cases is likely to create a more robust and testable theory than single case research. Multiple cases can increase external validity and help guard against observer bias (Eisenhardt and Graebner, 2007; Yin, 2003). Weighing up the pros and cons of single versus multiple case approaches, we considered that the optimum solution to achieve the aims of this research would be to combine the two approaches, as discussed below.

We focus on the aerospace industry as a useful example of complex engineering solutions. As a way to extend the dyadic approach (Spencer and Cova 2012; Vargo, 2009), the research was developed from identifying triads in the business network of a major aircraft manufacturing company on the world, named here EBR. This firm is as case of a solution integrator interacting with a customer and third parties for the provision of complex engineering solutions (Kaelen, 2014). Each triad, as a unit of analysis, is constituted by EBR as manufacturing company, NATAIR as customer firm and a service provider. All providers offer products or services which are part of EBR's value proposition to its customers.

As the single case of the integrator serves as umbrella for the cases of triads we develop the case study approach, considering two different levels of focus (Yin, 2003): 1) a specific aircraft manufacturer (EBR) and its integrated solution approach studied as a single case, which has the advantage of providing an overview of the focal firm while

at the same time supporting the development of managerial implications; and 2) a multiple case study considering all four individual triads for data on the variations across triads around a focal dyad made up of the manufacturer EBR and the customer NATAIR. Cases were thus chosen that predict either similar results or contrary results (Yin, 2003).

Data was collected through visits and interviews with managers from each member of the triad, involving a total of 33 hours interviewing (see Table 1.2 in section 1.3.4). In each triad, at least one manager was interviewed, targeting “informed” managers who had the most knowledge on the relationships established in each triad. Three interview scripts were prepared: one for the manufacturer, one for interviews with the providers and one adapted for customer interviews), as presented in Appendix 1 to 3. As the nature of this research is exploratory, the scripts contained open-ended questions, as: what products/services are exchanged between the parties? How can the history of relations between the companies be described? How are contracts established between the companies? At what stage of development is each dyad (in each triad)? How are the interactions and business processes between companies deployed? How do they perceive issues of power and dependence? What are the main sources of conflict? Which critical events can be described as influencing the development of relations? Secondary data sources, including such as articles and technical publications, provided a significant source of information, acting as backcloth to respondents’ comments and opinions.

Based on the phases analysed in dyadic business relationships, we considered to investigate here the development of each dyad (manufacturer-customer; manufacturer-provider and provider-customer) and of the triad (manufacturer-provider-customer) related to the provision of solutions. In line with the case study analysis method recommended by Yin (2003) and inspired by the grounded theory approach suggested by Strauss and Corbin (1990), the data collected through in-depth interviews were systematically transcribed and subjected to content analysis (Krippendorff, 2004). The coding and interpretation processes were undertaken using the NVivo10 qualitative data analysis software.

4.5 Case studies

Data was collected in order to highlight:

- EBR's general business context, solution approach and its links with the structure and evolution of the triads.
- The contract signed between NATAIR and EBR, the NAATAIR-EBR relationship, and the link with the structure and evolution of the triads.
- The structure and evolution of each triad taken separately.

The findings are presented in such a way as to form a chain of evidence (Barratt, Choi and Li, 2011) on the evolution of triads in the context of solution business. The case data is presented as follows: A description of EBR and of NATAIR; a description of the EBR/NATAIR dyad; a description of the dynamics of four identified triads involving this focal dyad and the actors at play.

4.5.1 EBR

EBR is one of the world's main aircraft manufacturers. With a global customer base and important internationally renowned partners, EBR has been offering, for more than 40 years, the most modern technology, versatility and comfort in airplane. One of the main products commercialized by EBR is the E-Jet family. This is a series of narrow-body medium-range twin-engine jets airliners. Launched in 1999, and entering production in 2002, the aircraft series has been a commercial success with sales up to 31 December 2014 of 502 options and 1090 units delivered. The aircraft is used by both mainline and regional airlines around the world.

As solution based strategy, EBR consequently develops a portfolio of product/service providers from a network of potential partnerships. In this way EBR is able, by mobilizing the appropriate partners, to offer services to airline customers both upon the sale of aircraft and throughout the aircraft's life cycle. EBR provides its customers with technical support, material support, maintenance engineering, operational support, technical publications, training programs and maintenance services. One important aftermarket service provided by EBR is the Spare Part Pool Program,

which provides the distribution and management of spare parts. The EBR Pool Program provides fast delivery of replacement parts and minimizes the need for inventory investments through an agreement by which the customer pays a given amount based on the number of flight hours of the aircraft enrolled in the program. EBR assumes responsibility for maintaining a parts inventory at its distribution and service centers, to provide parts to operators on a real-time basis. The decision then, by an airline, to purchase an aircraft where the Pool Program is involved thus presupposes the setting up of a long-term relationship with EBR.

4.5.2 NATAIR

NATAIR began as a national airline business in 2008. In 2009, the first year of operation, NATAIR gained 7 % market share. Six years down the line, its market share has progressed to 17%. This translated as an increase in the size of the fleet from 26 to 143 aircraft with passenger transport increasing from 4 million to 21 million per year. This represents one third of the country's domestic market serving 104 cities. NATAIR now ranks third largest national airline with a record-breaking growth:

“Proof that we are intensifying our business is that NATAIR, in 2008, started out with 900 employees. We now have more than 10.000” (NATAIR 01).

4.5.3 EBR-NATAIR

For EBR, NATAIR represents the most important national customer with potential for developing E-Jets sales in the national market.

“NATAIR is a great customer. It's an important player in the) commercial aviation market” (EBR 03).

“We rely on EBR since the beginning of our operations. This partnership has always been important to consolidate our business plan and thus grow in the domestic aviation market” (NATAIR 02).

Dealings between EBR and NATAIR took concrete form in March, 2008, with a purchase of a set of 36 EBR E-Jets, in the form of a business contract estimated at US\$ 3 billion dollars. The EBR solution approach is what led to this choice:

“EBR sells a package. We bought the aircraft along with a range of services. The use of ‘asset management’ programs, for example, avoids immobilization of capital in various components of the aircraft and helps avoid costs in logistics for repair of the goods” (NATAIR 02).

The first flight took place in December 2008, and the service dimension was at the heart of the concern since the initial phase. Indeed, certain service providers, such as the engine maintenance and repair service provider, were asked to participate in the discussions from the outset.

“For a more accurate assessment of total cost of ownership (TCO), we need to source engine, airframe and components maintenance when making aircraft purchase decisions” (NATAIR 02).

NATAIR chose to build its fleet around EBR for the most part due to:

“Its business-to-business networks for the provision of services related to maintenance and repair. If this network had not existed, we probably would have selected another manufacturer” (NATAIR 04).

“During this phase with NATAIR, suppliers worked closely together with us to adapt to requirements” (EBR 03).

As a result of the signature of the initial contract, major complementary suppliers were selected and agreements were signed direct with NATAIR. Since this first contract in 2009 NATAIR has remained faithful to EBR and has progressively completed its fleet exclusively with E-Jets purchases. More recently in May 2015, for example, EBR and NATAIR has reached an agreement for the sale of 30 aircraft. The contract also includes purchase rights for 20 additional aircraft of the same model, bringing the potential total order to 50 aircraft. The contract has an estimated value of \$ 3.2 billion.

“These 50 new EBR aircraft will be the most advanced in their category, providing fuel savings of over 20% as compared to the current model. This will be critical to maintain our competitive rates and to expand the domestic market” (NATAIR 04).

In December 2014, NATAIR started its first scheduled international flights. As of June 2015, the NATAIR fleet included 143 aircraft, comprising: 82 aircraft from EBR in operation (and six more on order); 61 aircraft from two other manufacturers, totaling 143 aircraft in all.

4.5.4. EBR-NATAIR+MOTORSERV

MOTORSERV is a maintenance and repair supplier of engines belonging to TECHPOWER, a world-leading manufacturer of jet aircraft engines. MOTORSERV operates in the market since 1976, with the ambition of becoming leader in the Latin America aviation turbine overhaul and repair business. The relationship between EBR and MOTORSERV began in 1996. Engine purchase is considered highly strategic:

“The choice of engine manufacturer is always made by the airline. We suggest the engine manufacturers we are used to working with and trust, but the airline makes the final decision” (EBR 03).

The engine is the most expensive part of an aircraft. Indeed, although bundled in with the overall aircraft contract, it can in many ways be considered as being an independent purchase, along with associated services. Thus, even in the early stages of aircraft purchase, service dimensions regarding the engines need to be at the heart of contracts:

“Half the cost of an airline is the cost of the engine... We sell services even at the time of the signature of the initial contract, because it benefits both us and our customers” (MOTORSERV 01)

MOTORSERV was selected by NATAIR in 2009 because on the one hand they are daughter company of the engine manufacturer TECHPOWER, and on the other hand they were recommended by EBR. MOTORSERV started to provide support of the engineering projects and technical support for EBR and NATAIR. Indeed, for the supply of aircraft to NATAIR Airlines, EBR has consequently developed an interactive interface with the engines supplier. Going beyond simple adaptations, the engine supplier has also simultaneously developed an interactive interface with the Airline, to facilitate development of specific technologies for the engine. In October, 2009, NATAIR and MOTORSERV established the business contract for maintenance and repair services for engines. The initial business contract was developed for 36 aircraft and was estimated at US\$ 1 billion. As a result of the development of the relationship, in October, 2014, MOTORSERV announced a US\$ 100 million investment plan over the next five years. This plan involves, amongst other things, the expansion of the operating capacity for maintenance and repair of large engines; the continued expansion of facilities; the construction of a bank of tests, and manpower training programmes. There are dedicated teams and representatives of all companies in the triad working together. There is a specific team from MOTORSERV working inside the OPSERV office, and the firms develop activities in close cooperation.

“We have a MOTORSERV office inside our company. Close integration of all three partners EBR, NATAIR and MOTORSERV is essential for best results”
(NATAIR 02).

As the fleet of NATAIR is growing, the relationship with MOTORSERV has also been intensified. The firms exchange resources frequently and are expanding their relationships:

“NATAIR’s record-breaking growth is directly associated to the valuable support of important partners such as MOTORSERV. Over the years, MOTORSERV has played a vital role in helping the airline achieve industry-leading operational standards. MOTORSERV handle the maintenance of NATAIR’s entire jet-engine fleet, in cooperation with a dedicated EBR team”
(MOTORSERV 01).

In addition, there is an interest in developing projects outside the provision of maintenance and repair services. The three companies interact to develop new products and services in order to obtain better results:

“In 2012, the partnership among EBR, MOTORSERV and NATAIR allowed the development of the first national flight with bio-kerosene. This is an example for the way we work together in order to co-create value” (EBR 01).

“These developments also showed that manufacturers of aircraft and engines are interested in reducing the carbon emissions of their new products and in working together with manufacturers to establish in advance the demand and benefit the whole aviation industry” (MOTORSERV 01).

“Supporting the development and use of sustainable biofuels in aviation is one of the industry's priorities and we are firmly engaged in this effort” (NATAIR 03).

4.5.5 EBR-NATAIR+OPSERV

OPSERV is a maintenance and repair service provider controlled by a European airline. OPSERV performs a broad range of services in the commercial segment from daily and overnight checks to technical training. It is a long-established national firm with which EBR has developed relations over the last 40 years. There aren't many companies providing the same services in the region. In 2010 OPSERV became an EBR qualified center which officializes their long-term relationship:

“For me, its looks like a marriage” (OPSERV 01).

“We trust in OPSERV because we have worked with them before, and are on a friendship basis with them” (EBR 04).

OPSERV is recommended by EBR to its airline customers, but the final choice as to which firm will maintain the fleet remains with the customer such as in the case of NATAIR in 2010. Additionally NATAIR, early in 2008, had already previously contracted directly some maintenance and repair services with OPSERV for its brand new E-Jets. Respondents indicated that the development of the long term relationship

between OPSERV and NATAIR brought with it advantages in terms of price and speed of service delivery. This qualification which was celebrated by OPSERV also marked the emergence of the EBR-NATAIR+OPSERV triad.

“When we were certified as an EBR qualified center, we held an event to celebrate this. We had many important people in our hangar and a NATAIR aircraft was put on show. In the middle of the part though, NATAIR had a problem with an aircraft in service. They needed to use the aircraft that was in our hangar. We took the one on show. Even today the guests think it was a flight simulation. That experience was interesting in that it demonstrates the importance we have in working together” (OPSERV 01).

Since this event, EBR, the manufacturer, plays a progressively increasing role in technical guidance and continuous improvements to aircraft. There are dedicated teams and representatives of all three companies working together. A representative of EBR, for example, spends two days a week inside NATAIR’s offices. At the same time an NATAIR team works together with the OPSERV team to monitor service provision. To use one OPSERV manager’s words:

“Each firm contributes with its own specific expertise as part of the team... They have a room with a computer and a phone in OPSERV’s offices. They work on monitoring and following up all services” (OPSERV 01).

The exchanges of resources among the firms can be seen in many situations:

“There is frequent exchange of resources. When we need an EBR engineer to give us support, he comes over to help us out. Often we pay his accommodation costs and food. NATAIR pays travel costs. The three companies cooperate to get results” (OPSERV 01).

“When our three companies started working together, for example, we needed a borescope, equipment used in the visual inspection of aircraft engines. We did not have this system yet and NATAIR lent one to us. If needs be, we exchange resources and equipment in this way” (OPSERV 01).

“We decide what basic elements inclusive elements of the offering the service provider will provide. It was decided that OPSERV offer a room with a computer, a printer, a phone, access to the internet and daily meals for two or three people. This is to guarantee the development of maintenance services included in the original contract. But as relationships evolve, the interchange of resources also increases” (NATAIR 05).

The firms also seek the best ways of solving problems together.

“For example, last year we, OPSERV, identified a service task that could be performed faster. We presented the suggestion to NATAIR and EBR and both agreed with it. With this improvement, we reduced costs for all parties involved” (OPSERV 01).

4.5.6 EBR-NATAIR+AFTERPARTS

AFTERPARTS is a leading provider of aviation parts and associated services. Be it for landing gear for a commercial jet, or a critical component for the latest turbofan engine, AFTERPARTS offers more than 900,000 different part numbers to customers globally. As a leading aftermarket provider also, AFTERPARTS is an exclusive distributor of equipment on behalf of aircraft manufacturers worldwide. Business between AFTERPARTS and EBR began in 2008. As an exclusive OEM supplier to EBR, AFTERPARTS is in a privileged position relative to EBR customers. AFTERPARTS provide EBR with a portfolio of solutions addressing logistics and sourcing needs, and were selected by EBR for their cost and efficiency advantages. AFTERPARTS do not work solely for EBR and vice versa, but do serve as Exclusive OEM partner. The present agreement between them grants AFTERPARTS Services rights to market, sell and distribute several thousands of highly sought after parts for EBR E-Jets.

“With the increase of the activities, we need to expand the team of AFTERPARTS that works inside EBR. Aftermarket services are an important area that we do not control” (EBR 04).

An AFTERPARTS representative works in the offices of EBR to cater for all coordination issues regarding all customers the two companies have in common, including from 2010 NATAIR.

“It’s common practice to implement an outsourced spare part program. There exist different types of spare part programs. Sometime, airlines work together for this provision between themselves. But it’s usual to have this service provided by the manufacturing firm. This is the choice NATAIR has opted for” (EBR 05).

The result is a particularly high level of interdependence between the three parties:

“AFTERPARTS help us with this service for our customers and also with other aftermarket services. It’s a win-win relation overall, and particularly important for the success of our dealings with NATAIR” (EBR 04).

“We need both the aircraft from the manufacturer and the services related to it. It’s essential for us to know that we can have AFTERPARTS as a supplier for the latter, given their reputation, and the excellent terms and working relationship they have with EBR. In fact it is one conditioning factor for having chosen EBR in the first place. It makes a perfect tightly linked threesome” (NATAIR 04).

The relationship between NATAIR, AFTERPARTS and NATAIR is still developing, however, due in part to NATAIR’s growth:

“We are excited about the opportunities offered by this partnership and believe it will significantly increase our offer of spare parts in the market. EBR has a gap in knowledge regarding aftermarket services and AFTERPARTS is the sole partner that provides this type of service for us” (EBR 05)

As NATAIR is a customer for the EBR Pool Program, the relationship with AFTERPARTS is frequent. As facts to support the expansion to long term relationship, the managers affirm that the firms need to support the fleet 24 hours, 365 days per year.

The Pool Program for replacement parts benefits customers through optimized inventory control that reduces the initial cost of investing in spares and infrastructure:

“With the growth of NATAIR, the importance of the partnership with AFTERPARTS as an exclusive OEM partner in EBR Pool Program also grows” (AFTERPARTS 01).

For fine tuning between firms involved, EBR organize some regular meetings with the partners of the Pool Program:

“There is a major annual event that is organized to support operators in reducing maintenance costs by sharing experiences addressing the best practices, in order to meet the continuous demand for increasing operating efficiency” (EBR 04).

“To gather manufacturer, operators and suppliers is an effective way to exchange information and experiences with operations and maintenance, seeking to increase the operating efficiency of the airlines that operate these jets, which is a key driver of our innovation in customer support” (AFTERPARTS 01).

4.5.7 EBR-NATAIR+ONBOARDMEDIA

ONBOARDMEDIA is a major provider of airline in-flight entertainment systems. Its main offering lies in an aircraft seat-back satellite television service, movie programming and also on-board Wi-Fi connectivity. The company is one of the four leading manufacturers in its field. The service provider for on board entertainment services is involved at various stages: the aircraft production stage, as a supplier of hardware and software, and following delivery of the aircraft as the supplier of software and subsequent upgrades. EBR already had previous established relations with ONBOARDMEDIA. In fact ONBOARDMEDIA equipped EBR aircraft for other foreign airline customers, such as B Jet and Alitalia, for contracts handled by other EBR teams abroad.

NATAIR got to know ONBOARDMEDIA through the experience of its Chief Executive Office who, in a previous position in B Jet, operated EBR aircraft in the US

equipped by ONBOARDMEDIA. Prior to 2010 no national airline provided on board entertainment services. The partnership between NATAIR and ONBOARDMEDIA began in 2010 with the provision of recorded media. In 2010, NATAIR referenced ONBOARDMEDIA as provider and decided to offer ONBOARDMEDIA programs on its fleet. Specific requirements of NATAIR related to the ability to broadcast TV programs live during flight, as provided by ONBOARDMEDIA.

From 2010 to 2012, EBR, NATAIR and ONBOARDMEDIA collaborated to develop in-flight TV for EBR-170-195 commercial aircraft. NATAIR required added services in order to cope with market evolutions. Implementing this system called for cooperation between ONBOARDMEDIA and EBR at the equipment installation stage, and subsequently during flight operation, for technical support. There is a representative from ONBOARDMEDIA working together with NATAIR and EBR. The role of EBR is to provide technical support and information in order to guarantee that the system can work well in each aircraft. ONBOARDMEDIA provides the services to install, support and maintain the system.

“In all, more than 30 professionals participated directly in implementing this project, which took more than three years work and collaboration between Engineering, Maintenance and Marketing departments”
(ONBOARDMEDIA 01).

As there is no other service center to support the ONBOARDMEDIA system, NATAIR depends solely on ONBOARDMEDIA for it. NATAIR also decided on a strategy here:

“As in-flight TV is a strong competitive advantage for us, we decided to set up our own specialized team trained by ONBOARDMEDIA to work in maintenance and supporting the system. We have the entire support of ONBOARDMEDIA, but also our own dedicated team to maintain the service in operation 24hours per day” (NATAIR 05).

As on board services are not presently part of EBR's services portfolio, the service provider ONBOARDMEDIA is an important third party for future development with customers. Whilst EBR does not actually invoice the on board service provided here (ONBOARDMEDIA does this) as they consider it outside their core activity, they

emphasize the importance of collaborating with the service provider to provide this solution for this customer, and other customers in the future.

“ONBOARDMEDIA is a firm that already has relations with other airlines in the global market. The provision of in-flight TV programs offers competitive advantage for our customers, and consequently for ourselves relative to serving our customers. Having ONBOARDMEDIA on-board as a new service supplier offers us a competitive edge” (EBR 02).

“Because it is a new technology, the project with NATAIR was a whole development of solutions for the customer. It was not just copy of what is done in foreign companies. We had to develop all the technology and infrastructure together” (EBR 04).

The relationship amongst the firms is intensifying because business processes are increasing with the NATAIR growth, as ONBOARDMEDIA is one of the major partners of it. As NATAIR is the only company in its country that has in-flight TV, this on-board service is sold as one of the major differential for the customers:

“The initial strategy of the firm was to install in-flight TV in some aircraft of the fleet. This was done for tests and adjustments until 2013, but now almost the entire fleet is equipped with this service and we continue with it” (NATAIR 05).

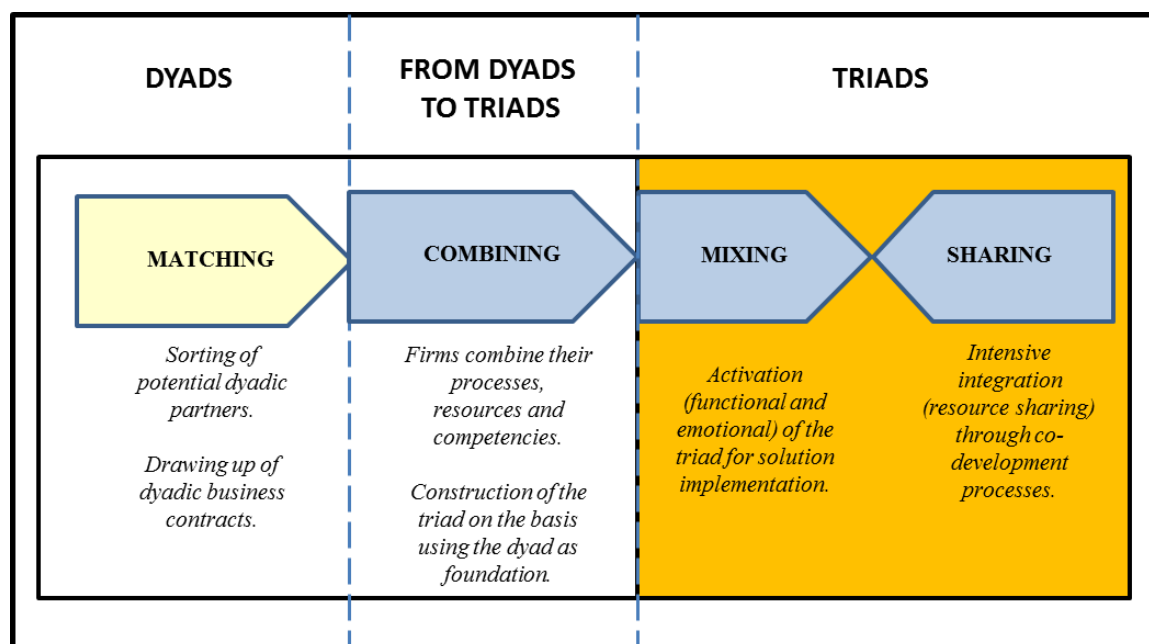
“Currently, I can say that the most important role of ONBOARDMEDIA is related to the provision of information. The system represents new technology for us, and ONBOARDMEDIA provides all type of answers to the development of the services: technical info and what else is need to develop and improve the service We are continuing improving the system together. As a new system, every day we have things to learn and develop” (EBR 05).

With a letter of intent for up to 50 new E-Jets all fully equipped with in-flight TV programs announced in July, 2014, NATAIR is poised to grow again. As in-flight TV is a competitive advantage for NATAIR, the firms are cooperating closely, and growing together.

4.6 Modeling Solution Relationship Development

A closer look at the dynamics taking place in the solution case presented here reveals shift in relationship status and configuration initially involving dyads, resulting in the formation of more or less permanent triads depending on context. Analysis of the data demonstrates four phases. These can be termed Matching, Combining, Mixing and Sharing, as illustrated in Figure 4.1:

Figure. 4.1: Phases in Solution Relationship Development



Source: Authors

4.6.1. Phase 1. Matching (Dyads)

The matching phase involves the initiation and development of dyads between three actors destined to form a quite distinct and identifiable (future) triad. Indeed in this phase, the supplier-buyer dyads can be seen to perform “practice matching” (Grönroos and Helle, 2010, p. 564) which is aimed at “aligning corresponding - supplier and customer - processes, resources and competencies”. More specifically, Grönroos (2011, p. 241) labels “practice matching” the fact ‘that the supplier and the customer develop or strive to develop the way they practice corresponding processes with an aim to be able to jointly support value creation in the customer's processes’ (typically the EBR-

OPSERV relationship for example, with qualification of the supplier OPSERV). From this perspective, a “practice matching process” (Grönroos and Helle, 2010) is for the supplier and the customer a process of mutual alignment of relevant practices in order to co-create value in the interaction.

These dyads can theoretically range on a continuum going from the ephemeral/ad hoc kind on the one hand, through to long lasting/highly integrated dyads. In practice in the examples in the case, interestingly, virtually all dyads demonstrated characteristics of the latter, as in the case of the relationships between EBR and OPSERV for example, likened to a “marriage”, or between EBR and airlines - in this case EBR and NATAIR - involved in the Pool program. Dyads can also range in stage of maturity with, recently established dyads a newly qualified provider as in the OPSERV initially. The result in the next – Combining – phase below is triads going from a loose nature, on the one hand, which serve a temporary specific function then disband or else which demonstrate weakness and are subject to a change of configuration, on the one hand, and tight triads, built to last, with a lasting function over time, and strong links between all parties. The latter clearly predominates in the EBR case. This is possibly due to the choice and characteristics of the EBR-NATAIR dyad, and the strategic nature of the EBR suppliers selected. Other cases analysed, not presented here, involving other EBR airline customers, revealed the existence of loose or weak dyads, with break off in relationships occurring. These however were not commonplace.

A pre-requisite for proceeding to the next phase, would appear to be, and fairly systematically in the cases observed here, the consolidation of the dyads via contracting to consolidate the Matching phase. This involves the signing of bilateral long term contracts between members of the future triad. This does not necessarily limit itself to the signature alone and can in certain instances, lead, for example, to a triadic manifestation - facilitating the next phase - in the form of an event to celebrate these contracts (see the EBR-OPSERV Qualified Centre event involving airline customers described earlier).

4.6.2 Phase 2. Combining (from Dyad to Triad)

The data also shows that relations leading to triads stem from business contracts signed between dyads (Manufacturer-Provider; Manufacturer-Customer; Provider-Customer). In the Combining phase the actors in the dyads can be seen endeavouring to combine their processes, resources and competencies to actively construct a triad on the basis of the aforementioned previously existing dyads. This amounts in fact to a process of combining the offerings (Karlsson, 2012).

Adaptations in terms of external organizing – i.e. organizing of relationships with third parties - are therefore required since “the initiating supplier will have to manage and shape its network, as well as shaping patterns of its partners” (Matthyssens and Vandenbempt, 2008, p. 325). This is facilitated in cases where two pre-existing dyads with a common actor involved are subsequently combined as in the case of EBR-ONBOARDMEDIA, on the one hand, and NATAIR-ONBOARDMEDIA on the other, again providing a “tight” triad as outcome.

The data also shows the – rare - emergence of triadic umbrella agreements. These seem to occur in instances where pre-existing strong dyads and associated contractual arrangements exist. An “...umbrella agreement is a joint consent which explicitly sets out a framework of principles with the aim of providing flexible guidance for future contractual decisions” (Mouzas and Ford, 2006, p.1249). The example identified in the EBR case does not, however, act as a framework to regulate the functioning of the triad as a whole. Rather it is an offspring of the triad, regulating the tri-partite EBR-NATAIR-MOTOSERV project for the development of engines operating with bio-kerosene. This, of course, also serves to consolidate the future of the tight triad and clearly lends itself to facilitating the emergence of events in subsequent phases of Mixing and Sharing below.

4.6.3 Phase 3. Mixing (Triad)

The four analyzed triads include multiple connections with both dyadic and triadic interactions but what gives life to the triad is the physical mixing of the central ‘solution interactors’. This phase is at the heart of the solution when people from the three

companies get to work together on site. A dedicated room can be used for this purpose, as in the case of the EBR-NATAIR+OPSERV triad. In all triads, we find this physical movement of people from one company working with people from the second company on the third company's premises. Onsite teams promote close relationships and the development of social capital among people. As argued by Holma (2012, p. 109) in the case of business triads at play in corporate travel purchasing, "physical access is a prerequisite to the creation of cognitive social capital to contribute to a profound understanding of the goals of cooperation, despite the possibilities the technology provides". As such the members of the three companies working as a team on a site form a "quasi-organization" spanning the triad.

However it is not just a question of working together as a team, it is also, as observed in the case of the event organized by OPSERV to celebrate their qualification, to have a party. Relationships among diverse organisational actors are difficult to build and manage. To facilitate the interactions and relationships between employees of the three companies, companies are using mixers or networking parties, that bring together people who do not all know each other and "provide a context in which they can interact freely to strengthen existing ties or forge new ones" (Ingram and Morris, 2007, p. 558).

4.6.4 Phase 4. Sharing (Integrated Triad)

This phase is 'optional', i.e. not all triads go through it. It is the sign of a higher level of integration between the three companies that exchange resources and co-develop new projects together. Sharing is at play between EBR, MOTORSERV and NATAIR for the development of the development and use of sustainable biofuels in aviation. Sharing specialized knowledge enables partners to learn more from each other, leverage partner expertise, and create collective knowledge, resulting in superior solutions (Ho and Ganesan, 2013). Thus, this phase of sharing leads to stronger links between manufacturer, subsystem provider and customer (Peng *et al.*, 2010). According to Nätti *et al.* (2014), sharing in a triad is facilitated when one of the companies forming the triad plays the role of "value-creation facilitator". For example, this role was played

by OPSERV in the EBR-NATAIR+OPSERV triad when it decided to work on performing faster some service tasks.

4.6.5 Market Shaping: from Triad to Network

Focus in this research is deliberately placed on an identified focal dyad and associated dynamics within the framework of a resulting triad, with a view to solution provision by a supplier, EBR. Individual triads have thus been observed and analysed, each providing answers relative to the provision of a partial solution to a customer NATAIR. The case data, however, clearly identifies linkages *between* triads for a same customer, i.e. a triad set concerning all triads linked to the EBR and NATAIR dyad, with a view to providing an overall solution offering.

At the same time, EBR can be seen, on a regular basis, to be selecting and developing dyadic relationships as building blocks and sources for future collaboration *not just for one* given customer, but within the framework of *other* existing or future triads. This whole process can be considered as market shaping for all actors involved in the triad (Geiger *et al.*, 2012).

4.7 Conclusions

Starting with the evolution of the business-to-business realm towards solution business, this paper aims at providing a better understanding of how relationships develop over time in such a renewed dynamic context. On the basis of a case study in the aerospace industry concerning the provision of complex engineering systems, this paper proposes a four phases model of solution relationship development: Matching; Combining; Mixing; Sharing. Each of the phases is detailed in order to highlight the dyadic or triadic context of the relationships. Whilst termed “phases” here, the process can be seen to be not a linear one, nor is it necessarily sequential and definitive.

Such a model of solution relationship development offers avenues for further research not only at the level of each solution triad but at the one of a set of related triads. What dynamics regarding combinations of triads for a same core supplier-buyer dyad? What interplay between dyads and triads with focus on not just one supplier-

customer dyad core as in the case presented and analysed here, but on combinations of the same, relative to a set of customers? Overall, we feel this model can serve as a base for a renewal of research on business relationships development and a revised perspective on business solutions.

Chapter 5

A DYNAMICS-BASED APPROACH TO SOLUTIONS TYPOLOGY: THE CASE OF COMPLEX ENGINEERING SERVICE SYSTEMS

RESEARCH HIGHLIGHTS

- Business solutions are provided in a relational and networked context
- Business solutions are dynamic, emergent, nonlinear by nature
- Servitization is a market-shaping process
- Solutioning involves each solution type independently whilst multiple possible combinations of types over time
- Solutioning is the overarching construct which includes different types of solutions

This article has been published in Industrial Marketing Management Journal as:

Ferreira, F.; Proença, J.; Spencer, R.; Cova, B. (2016). A Dynamics-Based Approach to Solutions Typology: A Case from the Aerospace Industry, Article in press.

It was also presented as a competitive paper in Industrial Marketing and Purchasing 2015 Conference, Kolding, Denmark, with the title “Towards a Typology for Business Solutions in Complex Engineering Service Systems”.

CHAPTER 5 - A Dynamics-Based Approach to Solutions Typology: The case of Complex Engineering Service Systems

Abstract

The process of servitization for manufacturing firms has been studied to help improve understanding as to how manufacturing firms can combine products and services in order to provide business solutions for their customers. Several proposals as to a typology for business solutions have been made. Typologies proposed are static in nature rather than dynamic. The aim of this paper is to propose a typology of the dynamic solution process, taking the aerospace industry as an appropriate context of analysis. A qualitative and exploratory research is adopted, using a case study approach. A triadic approach is applied in the selection of cases in order to capture the multi-actor base element of the network and solution dynamics. The data reveals four different time-based categories of business solution: 1) solutions before manufacturing; 2) solutions for manufacturing; 3) solutions for product performance and 4) solutions for innovation. This paper has theoretical and managerial contributions by presenting a typology for business solutions as a variable combination of products, services and developments over time.

Keywords: Aerospace; Business Solution; Market Shaping; Relationship; Servitization.

Introduction

Over the last decade (Oliva & Kallenberg, 2003; Salonen, 2011; Teboul, 2006) research has claimed that market complexity is forcing traditional product-manufacturing companies to change their position in the goods-services continuum by continuously expanding their offers into the service business. This process of transition from product to services in B-to-B markets is called servitization (Jacob & Ulaga, 2008). This is all the more in true in the case of complex systems provision such as to be found in the aerospace industry. Servitization captures certain aspects of the complexity of the business. This notion of servitization has naturally led to the development of solution offering. Recent years have seen a plethora of research production focusing on different angles of approach to solution (Nordin &

Kowalkowski, 2010; Storbacka, 2011). In spite of the fact that numerous studies have approached the understanding of the process of business solutions adopting a network approach, authors such as Briscoe et al. (2012) and Ng et al. (2011) affirm that more emphasis must be placed on dynamics rather than a state.

The research presented in this article seeks to explore this issue and answer the specific question: How typify the dynamic process for solutions framed by multiple actors? In order to investigate this gap, the aim of this paper is to propose a typology of the dynamic solution process, taking the aerospace industry as an appropriate context of analysis. We apply a triadic approach in the selection and analysis of cases in order to capture the multi-actor base element of the network and solution dynamics (Choi & Wu, 2009a, 2009 b). A case study approach is adopted. Individual triad cases are assembled to feed an umbrella case taking the solution integrator – FAB – as focal player. The dynamics at play are not only those of triads taken individually, but rather those between triads, taken from the perspective of a solution business integrated approach. The results of the case studies are then presented and discussed collectively.

The paper first summarizes on the state of the art regarding servitization, solution and project/market shaping in order to set the scene and identify gaps in the literature. Research method based on case studies and triadic units of analysis is then discussed. Finally the results of the case studies and suggestions regarding a typology of this dynamic process are presented and discussed. Four types of solutions are identified in dynamic terms and theoretical implications are explored.

5.2 Servitizing, solutioning and shaping

From the mid-1990s onwards companies in all kinds of industries - including such businesses as aircraft manufacturers - who have traditionally made and sold standalone products or systems have shifted their strategies (Nordin & Kowalkowski, 2010). Manufacturing companies have in fact developed the capabilities and organizational structures required to combine physical components and services provided by a variety of internal and external suppliers (Davies et al., 2006; Wise & Baumgartner, 1999). This greater service orientation is commonly referred to as ‘servitization’ (Jacob & Ulaga, 2008; Vandermerwe & Rada, 1988). Interest in servitization is attributed, in part, to firms attempting to develop new revenue

streams from services to accompany traditional product offerings (Davies et al., 2007; Kowalkowski et al., 2015; Oliva & Kallenberg, 2003; Wise & Baumgartner, 1999). The provision of servitized offerings is also considered a new source of competitiveness in the marketplace (Gebauer & Friedli, 2005). This trend towards servitization, however, provokes major organizational changes (Artto et al., 2015) including, for example, changes to the sales force (Ulaga & Loveland, 2014). According to Davies et al. (2006), providing the resulting customized solutions requires organizations to reconfigure around specific customer needs.

The development of servitization has led many companies to adopt a service-oriented approach and to offer comprehensive customer solutions. Indeed, today, “across industries and markets, firms marketing products and services are increasingly offering solutions” (Nordin & Kowalkowski, 2010, p. 441). A solution is usually understood as an integrated combination of products and services aiming to solve the customer’s problem (Storbacka, 2011; Tuli et al., 2007). Customers expect a solution to include processes directed at understanding their requirements, customizing and integrating products, deploying them, and supporting them on an ongoing basis (Oliva & Kallenberg, 2003; Tuli et al, 2007).

Various classification terms exist within the extant literature that describe the different types of solution offerings that manufacturers may provide when deploying a servitization strategy. Some authors (Mathieu, 2001) distinguish the elements of a solution on the basis of the direct recipient of the offer: On one hand there are the services supporting the supplier product (SSP) which “ensure the proper functioning of the product and or facilitate the client’s access to the product”, and on the other hand there are the services supporting the client’s action (SSC) which “support particular initiatives and advance the mission of the customer organization”. SSCs are thereby differentiated from SSPs by an involvement which is ever more downstream of the supplier’s actions with notably services supporting the client centred on the design of the application during R&D, services supporting the client during the production phase, and services supporting the client during the commercial phase. In the field of capital goods, Oliva and Kallenberg (2003) have completed this distinction between constituent elements by classifying the service across two dimensions: 1) the nature of the direct recipient, which takes us back to the distinction introduced by Mathieu (2001), e.g. product oriented services vs. end-user’s process-oriented services; 2) the temporal logic implemented in the offer e.g. transaction based services vs. relationship based services. The combination of these two dimensions leads Oliva and Kallenberg (2003) to define four types

of services which constitute the solution offering: based installed services (transaction based and product oriented); maintenance services (relation-based and product oriented); professional services (transaction-based and end-user process oriented); operational services (relationship-based and end-user process oriented).

Such classifications are generally content to assume a simplistic linear trajectory from product support services through to advanced services in the form of solutions (Kowalkowski et al., 2015). Some recent research attempts to remedy this state of affairs. The meta-theoretical research conducted by Oinonen and Jalkala (2013) on 57 studies published between the years 1999-2013 provides a better structuration of solutions. According to this research, only offerings that consist of integrated products and services and that are at least at some level customized and developed in a customer-need oriented way should be labeled as solutions. However, solution literature still lacks the dynamic dimensions (Biggemann et al., 2013) which would help to distinguish between different types of solutions (Nordin & Kowalkowski, 2010) and avoid the errors made in the name of this solution principle. Few studies investigate distinct solution process stages and, frequently, they tend to adopt limited views of solutions as linear processes (Sawhney, 2006; Tuli et al., 2007).

The representation of a solution as a long and complex process leads to investigate its evolutionary character (Biggemann et al., 2013). Similar to a project, a solution is not a piece of data, nor a predetermined form with which the actors can play. According to Miller and Lessard (2000), a project usually gives rise to a long process of co-creation in which the different actors participate to a greater or lesser extent. Project shaping thus is an activity which takes place throughout the project and involves many reconfigurations of the project (Cova & Salle, 2008). In the same vein, a solution might be seen as a continually evolving construct, a co-construction of the actors involved who ensure that their preoccupations and ideas are taken into consideration. In their study of the global mining industry, Biggemann et al. (2013) unveil the dynamic, emergent, nonlinear nature of co-created solutions, in which the interests of the parties change during the process. Indeed, only a few solutions arrive at their successful, predefined destinations. In the same way as innovation processes, solutions proceed through multiple steps, from idea generation to final implementation. This idea of co-construction applies throughout the whole solution process and at every type of decision.

The focus here is the importance of shaping practices, meaning activities that take place throughout a solution process—from generation to implementation—and which normally

lead to a host of (re)configurations. By using the frame of the four phases of project temporality, Cova and Salle, (2011) identify several shaping practices that highlight the dynamics of a project. This kind of framework could also help in understanding the evolutionary character of the solution process. Biggemann et al. (2013, p. 1089) emphasize, also, that the impact of solution shaping practices is not limited to a sole client-supplier relationship but could affect a whole industry: “A solution affects the customer–supplier relationship, which also influences other relationships and determines how competitors (i.e., other customers and suppliers) and other actors react. The introduction of a customer solution, in particular a novel one, may spark changes in the activities of competitors that want to influence the market in their favor and enhance their own market position. What starts as a possible solution to a specific, predefined customer problem can evolve to take on much wider scope, creating a new market space and changing the competitive environment”.

A linear, essentially dyadic process would seem then, according to the literature to date, to be insufficient and incomplete to understand solution dynamics. Storbacka and Nenonen (2011), through a case study on non-welded piping solutions, indicate that firms can actively alter market configurations by engaging in what they name “market scripting” practices: “offering market propositions that illustrate their view on how the market should be configured and engaging actors in activities aimed at creating a shared market view” (Storbacka & Nenonen, 2011, p. 255). Similarly considering solution dynamics as a supplier-led or customer-led – or even supplier/customer led process would appear to have limitations. Indeed, previous research has suggested that “solutions marketing, seen through a market-shaping lens, is not simply a question of handling solutions for customers. It calls for a broader approach and handling of the market and market dynamics, going beyond the dyad” (Spencer & Cova, 2012, p. 2). Adopting this perspective, “market solution” is defined as a reciprocal market shaping process: the solution process influences the shape of the market, whilst at the same time being influenced by forces at play in the market (solution *for* the market and solution *by* the market).

It follows then that the characterization of solution dynamics requires identification and consideration of steps and associated multi-actor motivations and involvement down this market-shaping process involving solutions, and going indeed beyond the

provision/acquisition of a given solution to include phenomena at play regarding solutions dynamics over space and time.

5.3 Methodological approach

Whilst partially framed by solution business theory, the research is exploratory, and hence calls for case research for theory-building purposes specifically targeting dynamics. Case study research is a method extensively used in management to investigate the decisions and behavior of groups and individuals within organizations and in inter-company relations (Barratt et al., 2011; Dubois & Gadde, 2002). This methodology is developed to examine complex problems with a view to identifying theoretical implications from a theory-building perspective. In particular, the method draws on the study of one or more cases of a given phenomenon in order to acquire an improved understanding of, or form a general conclusion about, the topic under study.

Some authors have argued that a single case study is justified or even preferable under certain conditions (Siggelkow, 2007): a single case study can show the impact of a large number of powerful and active contingent relations and the way they operate. Other authors (Eisenhardt, 1989; Eisenhardt & Graebner, 2007) argue that for theory building purposes the use of multiple cases is likely to create more robust theory than single case research. Multiple cases can augment external validity and help guard against observer bias (Eisenhardt & Graebner, 2007; Yin, 2003). Weighing up the pros and cons of single versus multiple case approaches, we considered that the adequate way to investigate this theme in the aerospace context would be to combine the two approaches, as the single case of the integrator serves as umbrella for the cases of triads (Yin, 2003). This choice has a direct impact in terms of sampling process and case selection, as detailed in the next section.

5.3.1 Data setting

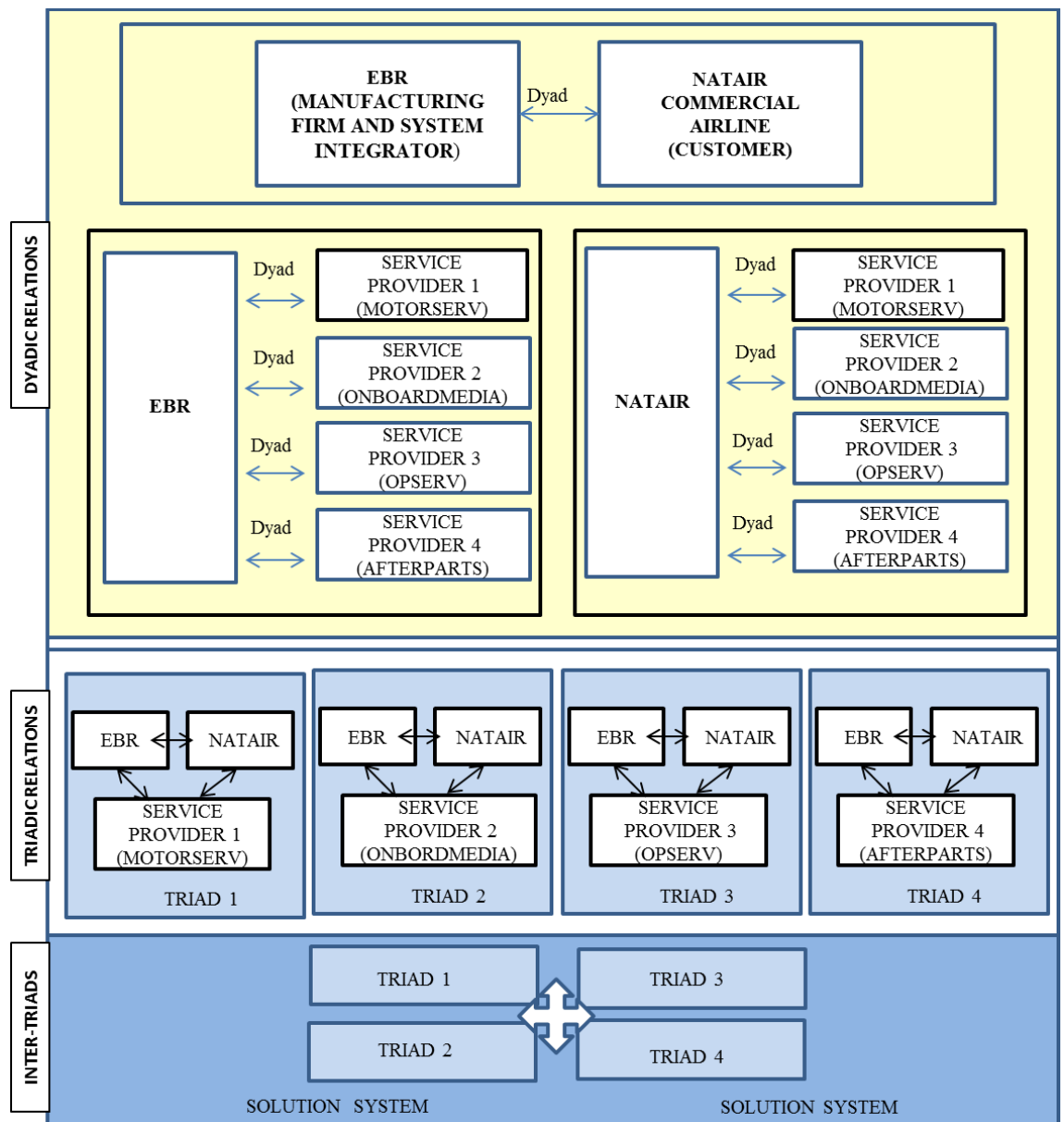
In a similar vein to recent research into complex engineering service systems (Ng et al., 2012), here we choose to investigate the aerospace industry, considering triads of actors as the unit of analysis (Choi and Wu, 2009a, 2009b; Peng et al., 2010; Van der Valk and

Van Iwaarden, 2011; Vedel et al., 2012). Typically, a triad of actors is involved in any outsourcing situation: the buyer, the supplier and the buyer's customer. In manufacturing, the buyer can act as a bridge between its supplier and its customer and maintain this bridge position before, during and after the outsourcing (Choi and Wu, 2009a). In each triad, we focused on the relationship between one major aircraft manufacturing company and its counterparts, as customers and service providers. The aircraft manufacturing company was considered the common hub for all triads, providing the focus, facilitating comparison and identifying its business network relationships for the provision of solutions. We considered a Service Provider as the third party (not a supplier of manufactured goods), to afford a clear illustration of service provision in business networks.

Relationships involving six firms in a solution process were analysed: one major manufacturing firm (as the common focal point of each triad), four service providers (two maintenance and repair service firms, one aftermarket services firm and one onboard entertainment services firm) and one customer firm. For a case study approach, the six firms were analysed from different perspectives: 1) the nine preliminary dyads constituted between them, 2) the four separated business triads developed for the provision of services, and 3) the inter-triads relationships related to the provision of solutions over time. Figure 5.1 illustrates the relationships analysed.

In the analysis of data, we first study the case of the specific aircraft manufacturer, EBR, and its integrated solution approach. The aim is to further the analysis of this actor's perspective as regards the development of the relations in which it is involved in the provision of solutions. This choice offers the advantage of providing an overview for the focal firm whilst at the same time supporting development of managerial implications. The second level of focus concerns the case of the dyad comprising the aircraft manufacturer EBR and the airline NATAIR, with emphasis on the contract between them for the supply of a batch of E-jet aircraft in commercial aviation. The aim here is to better understand the role of this relationship with the customer in the extant development of associated relationships in the provision of solutions.

Figure 5.1 – Dyadic and triadic relations developed by six firms as part of the EBR solution process



Source: Author

The third level of focus includes all triads developed between EBR and NATAIR with each one of the four service providers identified. The triads, all related to the FAB solution approach, lead us to the understanding of how relationships are developed over time between the firms and how these relations establish the engagement of manufactures, customers and suppliers as actors in the provision of solutions. Finally, at

a fourth level, we consider EBR's overall approach relating to the inter-triads involving EBR, NATAIR and all service providers. This approach allows us to find evidences in order to understand how the provision of solutions is developed as a relational and networked process. Although taxonomies are frequently derived from cluster analyses or other multivariate statistical techniques, they can also be obtained through direct observation (Wheelwright & Hayes, 1985).

5.3.2. Data collection

Data were collected from local visits and interviews with managers. In each triad, at least one manager was interviewed (including within the aircraft manufacturing firm), to identify informed managers who possessed most knowledge about the relationships established in each triad. Face-to-face interviews were conducted, involving a total of 28 hours' interviewing. As previously described in the Introduction of the thesis, Table 1.2 shows the firms investigated and how the data were collected via interviews in each firm. The respondents' identities are also presented. For reasons of confidentiality, the names of the companies and respondents have been disguised.

For improved reliability, following the data compilation process, the histories of the triads were presented to the interviewees for validation. Archival sources (e.g. documents and historical records) were used to contextualize the interviews. Three interview scripts were also prepared: one for interviews with the aircraft manufacturer, one for the service providers and one adapted to customer interviews. Initially, the triads were identified through interviews with managers in the manufacturing firm. Drawing on this identification, managers of service providers and customers were contacted and visits were organized. All scripts contained questions about the development of each dyad (Manufacturer-Customer; Manufacturer - Service Provider and Service Provider-Customer) and the triad (Manufacturer-Service Provider-Customer).

This being exploratory research, the scripts contained open-ended questions, covering various themes: What products / services are exchanged as solutions between the parties? How can the history of relations between companies be described? How are contracts established between the companies? How are interactions and business

processes between companies developed for the provision of solutions? What is the importance of each party in the provision of solutions? What are the main sources of conflict between companies? Views regarding relations were collected from all parties; i.e. manufacturer, service provider and customer managers expressed their views on the relationship of each dyad and triad.

5.3.3 Data analysis

The data collected through in-depth interviews were systematically transcribed and subjected to content analysis (Krippendorff, 2004). At the analytical stage, units used for content analysis purposes were sentences, paragraphs and phrases. Open coding was conducted by noting comments in each interview. Codification and interpretation processes were undertaken using software for analysis of qualitative methods, the QSR NVIVO 10 for windows. Data analysis is within-case and cross-case oriented. The findings are presented in such a way as to form a chain of evidence (Barratt et al., 2011).

5.4 Findings

The narratives of the development of the relationships involving EBR, NATAIR and the four service providers are summarized below. These have deliberately been curtailed as each case includes a considerable amount of data.

5.4.1 EBR, the Aerospace production context and the solution approach

EBR is one of the world's main aircraft manufacturers. With a global customer base and important internationally renowned partners, it offers Commercial, Executive and Defense aircraft. Aircraft manufacturing involves high technology, high complexity and the development of a global business network capable of providing support for the operating of the product over time. The aircraft is a long-lasting product and requires constant maintenance and updates by the manufacturer. This means the establishment of

a long-term relationship between Manufacturer and Customer, with constant interactions.

According to the interviewees, EBR produces aircraft while at the same time offering packaged services specific to the requirement of each segment which go beyond the usual aircraft-related services: *'We offer a product that is a solution'* (EBR 03). All in all, integrated solutions appear to be a win-win approach: *'The development of partnerships is essential to give the necessary support to our customers around the world. It is through these partnerships that we get the best cost-benefit ratio, both for us and for our customers'* (EBR 03).

In terms of solution based strategies, EBR increasingly offers integrated solutions going downstream with a high degree of integration of the offering within the customer's value chain, including aftermarket services. Consequently, EBR develops a portfolio of service providers from a network of potential partnerships, by mobilizing the appropriate service business units to offer services over an aircraft's life cycle: *'For better management, the strategy is to dispose a portfolio of partnerships allowing service provision around the world'* (EBR 01). EBR has both established its own service units (the EBR Service Centre), and has also set up a number of strategic partnerships to ensure the highest service standards for the EBR fleet worldwide.

5.4.2 The Manufacturing firm–Customer dyad EBR -NATAIR

NATAIR is a commercial airline that began business in 2008. The airline's business model focuses on stimulating traffic and boosting the national economy through a formula combining low prices and high quality services. In 2009, it purchased a set of E-Jets direct from EBR. According to NATAIR managers, the EBR solution approach is what led to this choice: *'EBR sells a package. We bought the aircraft along with a range of services'* (NATAIR 02). Even in the early stages of the relationship between EBR and NATAIR in 2008, the service dimension was at the heart of the contract and certain service providers were asked to participate in the discussions, such as the engine maintenance and repair service providers AFTERPARTS and MOTORSEV: *'We can't have our aircraft laid up. Once an aircraft is in the hangar, we are losing money. We need to keep our aircraft both in the air, and safe to fly'*

(NATAIR 03). NATAIR chose to build its fleet around FAB for the most part due to *'its business to business networks for the provision of services related to maintenance and repair. If this network had not existed, we probably would have selected another manufacturer'* (NATAIR 04)

The development of the backbone relationship between EBR and NATAIR can be better understood by consideration of the different phases structuring a multipartite partnership of this kind. We identified four phases: a pre-contract phase (Model Choice and Commitment) and three subsequent post-contract phases (Joint Definition; Manufacturing; Delivery/Operation). According to interviewees NATAIR 01 and NATAIR 02, both the aircraft as well as the supplier's overall ability to provide services throughout the life cycle of the equipment being offered are analyzed. The structure of the solution supplier's supplier portfolio is a critical issue, from the early stage of the relationship to the Delivery/Operation phase, as can be observed from the four triadic cases described below.

5.4.3.Triad 1: involving the service provider MOTORSERV

Triad T1 involves EBR, NATAIR and the service provider MOTORSERV. This firm is a maintenance and repair business unit belonging to a world-leading manufacturer of commercial and military jet aircraft engines and components. MOTORSERV provides maintenance and engine repair, components overhaul, engineering projects with technical support, and technical training. With an extensive global service network to support its activities, MOTORSERV has - as for all firms providing engine overhaul and repair services - some global competitors. Manufacturers thus benefit from privileged access to crucial technical information in relation to their own engines, which gives them an advantage, and has naturally led them to extend operations into the MRO (maintenance, repair and overhaul) field, and not only for their own products. Such is the case with MOTORSERV.

The relationship between EBR and MOTORSERV began in 1996. Engine purchase is considered highly strategic. According to interviewee EBR 03, *'the choice of engine manufacturer is always made by the airline. We suggest the engine manufacturers we are used to working with and trust, but the airline makes the final*

decision'. The engine is also the most expensive part of an aircraft. Indeed, although bundled in with the overall aircraft contract, it can in many ways be considered an independent purchase, along with associated services. Once selected, the core aircraft supplier/engine supplier/airline triad is established. In the case of NATAIR, MOTORSERV was selected, as it is a daughter company of the engine manufacturer POWER THRUST and an official MRO service provider – in accordance with the recommendations of FAB. The triad EBR – MOTORSERV- NATAIR began in 2009, when MOTORSERV started to lend in support of engineering projects and to provide technical assistance. Indeed, for the supply of aircraft to NATAIR Airlines, EBR has consequently developed an interactive interface with the engine supplier. Going beyond simple adaptations, the engine supplier has also simultaneously developed an interactive interface with the airline, to facilitate development of specific technologies for the engine. This triad is one of those in the sample demonstrating the highest levels of interaction and commitment among all firms involved. *'We have an office of MOTORSERV inside our company. Close integration of all three partners EBR, NATAIR and MOTORSERV is essential for best results'* (NATAIR 02).

5.4.4 Triad 2: involving the service provider ONBOARDMEDIA

Triad T2 involves EBR, NATAIR and ONBOARDMEDIA, an on-board entertainment service provider. Its main contribution lies in an aircraft seat-back satellite television service, film programming and on-board wi-fi connectivity. The service also offers live flight trackers, enabling passengers to see where they are currently located during flight. The company is one of the four leading manufacturers in its field. In the relation between EBR and NATAIR, the service provider for on board entertainment services ONBOARDMEDIA is involved at various stages: the aircraft production stage, as a supplier of hardware and software, and the stage following delivery of the aircraft (as the supplier of software). The triad EBR -NATAIR- ONBOARDMEDIA was established in 2012. This service provider was selected drawing on the experience of the Chief Executive Office of NATAIR airline with a previous airline, HIFLY, operating EBR aircraft in the US. Moreover, FAB had previously established relations with ONBOARDMEDIA. In fact ONBOARDMEDIA

equipped EBR aircraft for other foreign airline customers for contracts handled by other FAB teams abroad. On this basis the manager of the NATAIR contract thus cited ONBOARDMEDIA as provider, completing the triad. Specific requirements of NATAIR related to the ability to broadcast TV programs live during flight, as provided by ONBOARDMEDIA. Implementing this solution called for cooperation between ONBOARDMEDIA and FAB at the equipment installation stage, and subsequently during flight operation, for technical support. As confirmed by EBR 02, *‘ONBOARDMEDIA is a firm that already has relations with other airlines in the global market. The provision of in-flight TV programs offers competitive advantage for our customers, and consequently for ourselves in relation to serving our customers. Having ONBOARDMEDIA on-board as a new service supplier offers us an edge’.*

In other words, as on board services are not presently part of EBR’s services portfolio, the service provider ONBOARDMEDIA is an important third party for future development in relation to customers. At present, as relationships in this triad were formed rather recently (approximately a year ago), inter-firm cooperation and activities within the triad are still at the developmental stage.

5.4.5 Triad 3: involving the service provider OPSERV

Triad T3 involves EBR, NATAIR and OPSERV, a maintenance and repair firm. OPSERV is a qualified service center proposed by FAB and performing a broad range of services in the commercial sector. The relationship between the dyad FAB and OPSERV began in 2010, when OPSERV became a qualified centre. FAB respondents explained that OPSERV – a national firm -was considered an excellent maintenance and repair service provider, and that they had been working together for 40 years prior to OPSERV being bought out by a foreign group. OPSERV had already served the customer NATAIR before, but relations intensified after qualification of OPSERV by EBR. This qualification in 2010 marked the emergence of the OPSERV- EBR - NATAIR triad.

The respondents indicated that the development of the long term relationship between OPSERV and NATAIR brought with it advantages in terms of price and speed of service delivery. EBR, the manufacturer, plays an important role in technical

guidance and continuous improvements to aircraft. To facilitate this, resource exchange occurs via frequent interaction. There are dedicated teams and representatives of all three companies working together. A representative of EBR, for example, spends two days a week at NATAIR's offices. At the same time a NATAIR team works together with the OPSERV team to monitor service provision. When asked about the state of the triad, managers described the relations between all parties as close and intense with frequent interaction. Managers of both FAB and OPSERV compared the relationship to a 'marriage' and used the word 'familiarity' to describe the advantages of their long-term relationship: *'For me, it looks like a marriage'* (OPSERV01). The relationship between OPSERV and NATAIR also demonstrated high levels of interaction and familiarity. Mutual trust and commitment, and co-creation of value were terms used to describe the relationships between these three companies.

5.4.6 Triad 4: involving the service provider AFTERPARTS

Triad T4 involves EBR, NATAIR and the service provider AFTERPARTS, a leading provider of aviation parts and services. AFTERPARTS describes itself as a provider of a portfolio of solutions that address the industry's logistics, warehousing, program management, and sourcing needs, offering services related to repair management, asset management and distribution. Business relationships between AFTERPARTS and EBR began in 2008. AFTERPARTS is considered by FAB respondents as a strategic supplier. Since start-up of the triad, close collaboration and intensive exchange has taken place, involving all three parties. An AFTERPARTS representative works in the offices of EBR to cater for all coordination issues regarding all customers the two companies have in common. In particular, for this triad, given the strategic importance of NATAIR to EBR, especially close cooperation takes place to ensure services provided via the 'Pool Spare Parts Program'. The result is a particularly high level of interdependence between the three parties. In the words of AFTERPARTS: *'Because we depend on EBR to have access to customers... but also because we are service providers to the EBR program, I believe that EBR has more power in this relationship'* (AFTERPARTS01). EBR sees the situation as being more balanced: *'We are unable to offer all this distribution by ourselves. AFTERPARTS help*

us with this service for our customers and also with other aftermarket services. It's a win-win relation overall and particularly important for the success of our dealings with NATAIR' (EBR04).

NATAIR supports this analysis, declaring: *'We need both the aircraft from the manufacturer and the services related to it. In fact AFTERPARTS is one conditioning factor for having chosen EBR in the first place. It makes for a perfect threesome'* (NATAIR04). Therefore a close triadic set-up, involving all parties, applies for all services covered by the Pool Program. However, other services outside the scope of the Pool Program can be offered by AFTERPARTS and invoiced direct to NATAIR, without involving EBR.

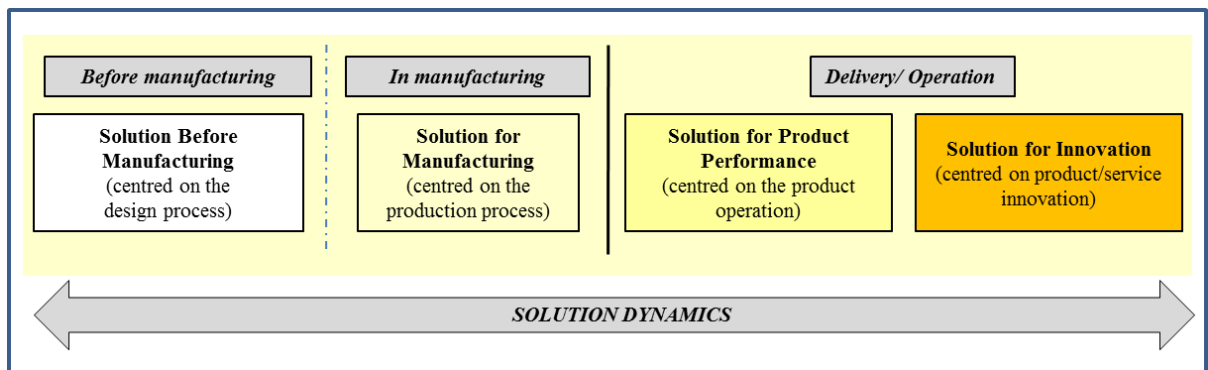
5.4.7 Inter-triad links

To complete our description of the individual cases described above, it is useful to understand the context in which these triads evolve, and the links between them, as described by the interviewees. Thus, by way of illustration of these links, OPSERV, for example, being a provider of maintenance and repair services, can be seen to play an important linking role across triads. As mentioned by the interviewee MOTORSERV 01, *'the engine is a strategic component. We are sometimes called upon to provide service on OPSERV's premises. We thus, at the same time, work in close conjunction with them to ensure continuous improvements'*. Moreover, a manager from ONBOARDMEDIA backs this up by saying *'the role of OPSERV was crucial in the process of changing aircraft for installation of ONBOARDMEDIA on board. As many aircraft are in operation, we needed to ground them to make the changes. OPSERV is very important to this process'* (ONBOARDMEDIA 01). The same logic applies for Triad 4 (EBR-NATAIR-AFTERPARTS) and OPSERV. AFTERPARTS, *'as a distributor of the Pool Program, help us in order to reduce time. The faster we are, the better for NATAIR'*, affirms manager OPSERV01. The triads can thus be seen, in virtually all cases, to demonstrate interlinkages, and indeed some kind of interdependency.

5.5 Implications: Four types of solutions in dynamics terms

The data brings to light the fact that the provision of solutions between EBR and NATAIR is neither linear nor static. A dynamics-based approach to solutions typology is identified, as discussed below. From the data, we identify four categories of solution in the aerospace case studied: 1) solutions before manufacturing; 2) solutions related to manufacturing; 3) solutions for product performance and 4) solutions for innovation, as illustrated in Figure 5.2.

Figure 5.2. A typology of the dynamic solution process



Source: Author

These categories detail the way that, in each phase, the solution calls upon different combinations of both products and services, as well as capabilities, knowledge and resources. Before manufacturing, (a time-frame that can last up to a year here), the customer requires issues related to the design of the fleet to be resolved. The main issue is that of designing the best fleet, in order to approach the market with the most appropriate aircraft. In the subsequent time-frame the solution is more related to the process of production, i.e. involving tangible goods and services related to manufacturing. Deadlines need to be met, requiring an orchestration by the manufacturer so as to be able to produce and/or access resources. Once the aircraft has been delivered, the issue is one of solution integration, more related to the performance of the fleet. Products (such as spare parts or components) and services (maintenance,

repair, and training) are combined in order to guarantee what was agreed by the initial business contract with the Customer. This time frame lasts longest. However, if firms perceive that they can work more closely together for the development of new services and/or products, a further “Solution for Innovation” time-frame may be involved. Firms may thus develop more integrated activities in order to create new market opportunities or competitive advantages. Products and services can be developed as new technologies, establishing high levels of interactions and interchange of resources among partners. In sum, the dynamic provision of solution can be identified through the different combination of products, services, people, material/equipment and information over time:

- 1) Solution Before Manufacturing -The provision of solution here relates to the initial design of the product. Services provided are related to joint definition of the aircraft configuration and customization, involving the articulation of network partners. Integrated teams with suppliers directly involved in designing are called for, and material/equipment, hardware, software and systems related to designing are important here. The manufacturing firm’s reputation and all technical expertise for designing the product are relevant for the appropriate provision of solutions before manufacturing.
- 2) Solution For Manufacturing - The provision of solution is centred on the production process. The manufacturing firm must be able to produce and/or access tangible resources and services related to production. Products handled here are all components and other parts used in manufacturing. Services are those related to manufacturing, involving the ability to articulate with partners in order to execute the plan for aircraft configuration. People concerned belong to integrated teams involved directly with manufacturing. Hardware, software, systems for manufacturing are required as well as materials/equipment. Know-how for manufacturing, as well as knowledge about the market and competitors are relevant information for the provision of solutions related to this manufacturing time-frame.

- 3) Solution For Product Performance - The provision of solution is centred on optimization of product performance. Services are required to support and develop the product over time. Products are related to the fleet in operation, components and spare parts. Services are related to maintenance and repair, training and other services to promote improved performance. People are specifically support-oriented. Hardware, software, and systems to support products and services are required. Know-how for support relates to information relevant to product performance.
- 4) Solution For Innovation - The provision of solution is centered on the innovation of products and/or services. Products are related to the development of to the fleet in operation in order to obtain innovation. This innovation involves services developed to guarantee improved performance, but also to provide differentiation. Integrated teams are directly involved in the innovation processes. Materials include hardware, software, systems to support products and services innovation. Know-how for the development of new products and or services is innovation-focused.

In the case observed here, firms with mature relationships can be seen to be involved in several of the above-mentioned situations simultaneously (as expressed by the reciprocal arrow in figure 2). A solution for product performance, for example, can be concurrent with the development of solutions for innovation for general market applications (the case of the development of bio-kerosene between EBR, NATAIR and MOTORSEV). As the relationship between NATAIR-EBR evolves, repeat purchases occur and different teams can be observed working on different combinations of products and services to reach specific goals. EBR can provide business solutions for innovation related to a fleet that operates in a given market segment, alongside the provision of solution before manufacturing involving a purchase of a different fleet that will operate in a new segment, for example. As providing solutions is a dynamic process, it is interesting to highlight the fact that this case, as described above, is related to a customer's purchase of a first fleet. However, new aircraft can be ordered, with different stages of the relationship consequently being developed simultaneously. The

greater the knowledge and involvement between the manufacturing and the purchasing firms, the more varied are the combinations of products, services and other works that can be developed at each stage. In the case of new orders, the relations established for the first purchase may influence the provision of solutions in the repurchase, resulting in a different and thus evolving combination of products, services, people, equipment etc.

Adopting such a dynamic perspective requires a conceptual shift from the notion of solution per se to the broader notion of “solutioning”. Solutioning does not have to be misused in the sense of describing the process of *creating* a solution, but rather to be used to take into account the whole dynamic system of solutions including the four different types, the multiple actors, and their interconnections into triadic combinations. Solutioning involves the consideration of each solution type independently whilst at the same time considering the multiple possible combinations of types over time. This implies that solutioning might be seen as an overarching construct, an on-going co-construction of the multiple actors involved, which includes different types of solutions. Indeed, the different types may be observed to be taking place simultaneously for a same customer relative to different transactions occurring for and with that customer. This means overall that more attention needs to be paid to the solutioning system than to the solution items, and in particular to the linking roles of actors across solution triads as seen in the case. This solutioning process, similarly, does not take place relative to one customer alone, independent of other customers. It can be seen to be a cross-crossing process. Solutioning with and for one customer can impact on the solutioning relative to other customers and vice versa.

5.6 Conclusion

Taking a case study in the aerospace industry as backcloth, this paper presents the results of empirical research to propose a typology for business solutions as a dynamic process. Collected using a case study approach and method, the data first confirms that solutions are provided in a relational and networked context and process. The combination of products and services required by the customer can change according to different phases of the relationships of the different actors (customer and service providers) with the manufacturing firm. Second, the inter-linked relations developed

between EBR, NATAIR and the four service providers show that business solutions can be understood not as the result of a linear process, but, on the contrary, as a result of multiple parallel evolutions of component contributions to the solution. As a solution integrator, the manufacturer needs to guarantee the provision of goods/services throughout the life cycle of the equipment. As the relationships evolve, different combinations of products, services and developments are required, being provided in collaboration between the customer and other partners over time.

This fresh categorization of business solutions related to each phase of the relationship has important theoretical implications. Our categorization of business solutions (solutions before manufacturing / solutions for manufacturing / solutions for product performance / solutions for innovation) answers Biggemann et al. (2013)'s theoretical call to take into account the dynamic, emergent, nonlinear nature of business solutions and the fact that the stakeholders and their relative interests can change during the process, thus affecting the definition of scope of the solution. More specifically, our fourth category in particular, "solution for innovation" embodies the market shaping effects of such solutions (Spencer & Cova, 2012). Solution effects resulting from innovative efforts of the triad formed between the manufacturing company, the service provider and the customer are not limited to customer-specific value outcomes but may also influence other market actors and even shape the market.

This study also highlights the fact that moving to a service-oriented approach means that manufacturing firms need to consider servitization (Jacob & Ulaga, 2008) as a market-based process, and indeed a market-shaping process. It also demonstrates, through the triadic perspective adopted, that the trend towards servitization provokes significant intra-organizational (Artto et al., 2015) and inter-organizational change (Ferreira et al., 2013).

In terms of limits to the research presented here are the fact that, on the one hand, the data collected relates to a set of triads all located within the same national boundaries and the same manufacturing organization, thus the same industry. On the other hand, the majority of the triads are also recently formed, and thus observation of the relationship dynamics is limited. Scope for further research, then, includes the need to consider multiple manufacturing firms and multiple industrial settings relative to the solutions realm. Moreover the findings and proposals presented here should provide a

basis for future research including not just a dynamic perspective to solutions, but integrating at the same time the notions of multi-dimensionality and simultaneity of solutions.

Chapter 6

CONCLUSIONS OF THE THESIS

CHAPTER 6 – CONCLUSIONS OF THE THESIS

This chapter is the final chapter of the thesis. Here, the main conclusions of this research are summarized. Furthermore, the scientific and managerial contributions are highlighted as well as discussing the limitations and future research avenues.

6. 1 Theoretical Implications

This thesis investigates how products and services are combined as business solutions in a network-focused process with complex engineering service systems as the context of analysis. The focus is not on the servitization process and how manufacturing firms can continuously extend their service business by extending the service portfolio (Salonen, 2011; Kindstrom, 2010, Reinartz and Ulaga, 2008; Grönroos, 2007, 2006; Campbell-Kelly and Garcia-Swartz, 2007; Teboul, 2006; Oliva and Kallenberg, 2003; and Chesbrough and Rosenbloom, 2002). The discussion here is instead about how manufacturing firms can move to a service-centric logic, understanding the combination of products and services as business solutions that are co-created with customers and suppliers over time through a relational and networked process (Smith et al., 2014, Spencer and Cova, 2012, Spring and Araújo, 2009, Davies et al., 2006; Windahl et al., 2004). The servitization of manufacturing firms in complex engineering service systems involves relationships between the manufacturing firm, customers and third parties (Smith et al., 2014; Tuli et al., 2007; Kapletia and Probert, 2010; Araújo and Spring, 2006; Ford et al., 2003, Davies et al., 2006; Windahl et al., 2004). The analysis of the aerospace industry provides some contributions to understanding how solutions are not only networked-based but a market-shaping process (Spencer and Cova, 2012).

The aim of this thesis is to present how products and services are combined as business solutions in complex engineering service systems and developed in a network-focused approach. The research is developed through three papers. First, Paper 1 (Chapter 3) addresses the external business model fit and dynamics to answer the subjacent question on how the provision of solutions as a network-focused process can be described. Paper 1 highlights the interplay of products and services and the dynamic

nature of business models over the relationship lifecycle between the supplier and customer dyad in the aerospace industry. As the case of the manufacturer EBR and the customer NATAIR shows, the provision of solutions requires external business model fit. This is not simply an issue of unilateral or bilateral adjustments between the manufacturing firm and the customer, but a relational development among partners in the network. In providing solutions, the manufacturer and customer continuously shift the form and content of their respective business models to adapt to the counterparty's needs and the market context. The result is an intricate real-time intertwining of business models among all actors directly involved in the solutions network. This can be likened to an immense multi-dimensional jigsaw puzzle where the shapes of the pieces shift over time as well as the interconnections between them, with consequences for the overall picture of the market itself. Answering the first subjacent research question on how the provision of solutions as a network-focused process can be described, Paper 1 highlights that a solution business model is neither firm-focused nor dyad-focused, but rather network- and even market-focused, demonstrating that a solution business model is not static but dynamic. This implies that manufacturing firm servitization in this context can also be seen as relational and network-focused, calling for studies on the relationship dynamics for business solutions that go beyond the dyadic context. For the solution provider this means placing at the core of the business model not only relationships with the customer, but also relationships with suppliers of parts and components and/or service providers in a triadic fashion (Choi and Wu, 2009a, b).

From this perspective, Chapter 4 (Paper 2) proposes a phase model for solution relationship development entailing the evolution of the dyadic and triadic relationships in complex engineering solutions. Answering the second subjacent research question on how firms can foster relationships to develop business solutions over time, four dynamic phases that outline the solution provision dynamics are identified: matching, combining, mixing and sharing. These phases are in line with Smith et al.'s (2014) notion that the servitization process is evolutionary and requires a complex systems perspective. As in the case of complex engineering service systems, the key unit of analysis is a triad of actors (Van der Valk and Van Iwaarden, 2011) and the solution set presented in Chapter 4 contributes to understanding this complexity. Considering

Chapters 3 and 4, the data also bring to light that the provision of solutions is a non-linear, dynamic and variable process. As relationships are dynamic, the solutions can also vary over time. Answering the third subjacent research question on what different types of product-service combination can be identified as the relationships among partners evolve, Chapter 5 (Paper 3) contributes to bridging the gap in literature by presenting a dynamics-based approach to a solutions typology. Taking the complexity of relationships between firms, the data identifies four different time-based categories of business solutions provided in complex engineering service systems: 1) solutions before manufacturing, 2) solutions related to manufacturing, 3) solutions for product performance and 4) solutions for innovation. Chapter 5 (Paper 3) contributes to the manufacturing firm servitization discussion with a network-focused view as well to understanding how solutions can vary and be provided by multiple parties in a business network.

The thesis contributes to the growing body of literature on the theoretical and managerial aspects of the provision of solutions in a network perspective. This thesis concludes that, in complex engineering service systems, to understand the combination of products and services as business solutions, observation through the triad lens also provides improved knowledge and new potential for researchers and managers alike. The solution approach generates a myriad of parallel triads simultaneously involving the aircraft manufacturer as the buying organization, the airline as customer and the associated service providers, here called the “solution set”. This triad approach goes beyond the scope of the dyad while at the same time limiting the network analysis complexity. A genuine triadic unit of analysis can be seen to exist and is observable from a research perspective, but is also perceived as an operational entity from a managerial perspective. In the cases studied here, the triad lens sheds new light on the inter-relations within the triad. This lens acts as a specific perceptual approach that exposes thus-far hidden aspects of reality and provides a higher level of sense-making. The solution business triads identified and analysed in this research also offer food for thought on the dynamics *between* dyads and triads within the framework of a given solution set. Indeed, the triad lens must go beyond the isolated approach to consider how triads are mutually embedded in providing the same solution. In other words, no triad is an island and a triad operates in a sea of triads, also constituted by previous

dyads. As the development of relationships is an evolutionary process, the focus of this thesis is not an analysis of a triad of actors instead of a dyad, but an analysis involving the evolution of dyadic and triadic relationships, i.e., the interplay among firms constituting a solution set and interacting in the provision of business solutions over time.

However, the analysis of the functioning of the “solution set” shows that the very nature and dynamics of business triads in the aerospace industry are dependent on the manufacturer-customer dyad at the heart of the solution. This is a prerequisite to understanding the interactions among dyads and triads at play. Our research clearly demonstrates this interplay and a triad lens alone would be insufficient. Indeed, an inter-triadic approach, considering a set of triads and previous dyads, would seem to offer better understanding of the solution provision dynamics in complex engineering service systems.

6.2 Managerial Implications

These theoretical contributions lead to some managerial implications. The analysis undertaken could be useful to managers by providing better understanding of how solutions are developed in the context of complex engineering service systems. First, the servitization process in complex engineering service systems implies managing the relationships in the business network over time. The findings highlight the dynamic nature of business models over the relationship lifecycle and the need for the reciprocal adjustment of the models. This means that managers need to focus not only on the product or service *per se*, but on developing relationships with partners that enable providing business solutions over time.

Since the solutions business can change as the relationships evolve, managers could focus on the most expected combination of products and services for each phase of the relationship. No single combination of products and services is provided to the same customer. Indeed, managers can provide different combinations as the relationship with the same customer evolves. This means that different strategies can be developed for each stage of the relationship. To extend the customer portfolio as a system integrator, the manufacturing firm must to be able to offer different combinations of

products and services in accordance with the needs of each customer. Considering the triads of actors as a way of managing the network, managers can use the inter-triadic approach to develop their strategies. The contribution here is in showing with empirical data that a set of triads (constituting a solution set) can influence or be influenced by each other. This highlights the importance of business contracts involving the three parties as a way of fostering competitive advantages.

6.3 Limitations and Future Research

This thesis has the limitations of any case study research. First, the data collected relates to a set of firms located within the same national boundaries. Second, the majority of the triads identified (and the previously related dyads) were recently formed and thus observation of the triad dynamics is limited. Third, the findings are relevant for the solutions business, but the question remains as to whether the results are applicable to other situations outside the solutions business in complex engineering service systems.

This investigation can encourage further research into the inter-relationships between network partners providing solutions. Future research could consider different types of relationships in complex engineering service systems such as other third parties as suppliers of goods (not services). Furthermore, the interplay among triads and previous dyads could be analysed in other sectors for comparison. Future research may consider hypothesis testing and using more quantitative methods while the four-phase model described in Chapter 4 and the categories of solutions in complex engineering service systems could be tested in other contexts.

Appendix

APPENDIX 1

The script is presented in portuguese as the original language of the interviews.

Entrevista com gestores da EBR (empresa fabricante dos aviões)

PARTE 1 – SOBRE A EBR

A parte I deste roteiro tem por objectivo levantar dados sobre a empresa EBR e sua rede de negócios:

- 1) Quando a EBR foi fundada?
- 2) O que a EBR oferece aos seus clientes?
- 3) Como a EBR está estruturada?
- 4) Quais são os produtos e os serviços oferecidos pela Embraer?
- 5) Consegue separá-los como ofertas independentes?
- 6) Quais são os clientes da EBR?
- 7) Como a EBR atua para atender as necessidades/problemas dos clientes?
- 8) A EBR busca relações com outras empresas para conseguir ofertar o que os clientes necessitam? Se sim, quem são estes parceiros?
- 7) Na relação com a NATAIR, quais fornecedores principais podem ser identificados?
- 8) Quais os tipos de interface existentes com cada um destes fornecedores? Quem são os responsáveis?
- 9) Como o(a) sr(a) pode descrever a rede de negócios da EBR na aviação comercial?

PARTE II – SOBRE O MODELO DE NEGÓCIOS DA EBR

A parte II deste roteiro tem por objectivo identificar o *Business Model* da EBR para a oferta de soluções de negócio, considerando-se os elos com os fornecedores e clientes.

ESTRUTURA DA REDE

- 1) Quais os tipos de cliente a EBR possui (B2C; B2B ou ambos?)
- 2) Qual tipo de cobertura oferece (local/ regional/ nacional/ internacional)?

- 3) Qual a posição da empresa na cadeia de valor?
- 4) Qual a abrangência de mercado (mercado amplo/ múltiplos segmentos/ nicho de mercado)?
- 5) Qual a importância dos fornecedores no modelo de negócios da EBR?
- 6) Qual tipo de interação estabelece com clientes (transacional/ relacional)?
- 7) Qual tipo de interação estabelece com fornecedores (transacional/ relacional)?
- 8) Pode-se afirmar que o modelo de negócio da EBR é baseado em transações ou em relacionamentos?
- 9) Pode-se afirmar que o modelo de negócio da EBR é orientado a produção ou ao cliente?

OFERTA (SOLUÇÕES)

- 10) A EBR oferta principalmente produtos/ principalmente serviços / ou um misto?
- 11) A EBR oferta padronização/ alguma customização/ alta customização?
- 12) Como pode descrever a oferta da EBR em termos de solução de negócios para o cliente?
- 13) Qual a importância das tecnologias para o modelo de negócio da EBR?
- 14) Quais as tecnologias consideradas estratégicas no modelo de negócio da EBR?

CAPACIDADES / HABILIDADES

- 15) Quais capacidades ou habilidades são consideradas estratégicas?
- 16) Quais as fontes de competência (capacidades ou habilidades) que fazem a empresa ter melhor performance em comparação aos concorrentes?
- 17) Como a EBR acessa os recursos tangíveis que necessita?
- 18) Como a EBR acessa os recursos intangíveis que necessita?
- 19) Quais recursos são considerados estratégicos?
- 20) Como estão organizados os processos de negócio da EBR?
- 21) Existem sistemas de gestão?
- 22) Pode-se afirmar que o modelo de negócios da EBR é aberto ao acesso de recursos na rede de negócios?

MODELO DE LUCRATIVIDADE

- 23) Qual o modelo de lucratividade da empresa?
- 24) Qual o modelo de investimento da empresa

CONFIGURAÇÕES DO MODELO DE NEGÓCIO

- 25) Com base nestas características descritas, quais as proposições de valor da EBR que a tornam única?
- 26) A EBR ajusta elementos de seu modelo de negócio de acordo as mudanças de mercado?
- 27) Como se pode descrever o modelo de negócio da EBR em relação ao cliente NATAIR?

PARTE III - COMPREENDENDO CADA TRÍADE

A parte III deste roteiro tem por objectivo levantar dados sobre os relacionamentos diádicos e triádicos das empresas em estudo.

Entrevista para cada tríade. Deve ser respondida sobre as relações estabelecidas em cada tríade.

INDÚSTRIA: EMBRAER

CLIENTE: NATAIR

FORNECEDOR DE SERVIÇO: _____

- **AS RELAÇÕES DIÁDICAS:**

DÍADE EBR-CLIENTE

- 1) Há quanto tempo a EBR tem relações com esta Empresa Cliente?
- 2) Quais produtos/serviços a EBR oferece a esta Empresa Cliente?
- 3) Pode descrever como é (foi) a relação desenvolvida entre a EBR e a Empresa Cliente? Pode descrever um breve histórico desta relação?

- 4) Existiu uma relação diádica (apenas entre EBR e Empresa Cliente) antes da relação com este Fornecedor de Serviço? Quando começou?
- 5) O(a) senhor(a) pode descrever o estágio atual da relação da EBR com esta Empresa Cliente em termos de evolução do relacionamento: 1) conscientização/reconhecimento do parceiro de negócio; 2) exploração/experimentação; 3) expansão; 4) compromisso e 5) dissolução?
- 6) O(a) senhor(a) percebe (percebeu) alguma mudança nos processos de negócio entre estas duas empresas ao longo do tempo de acordo com a evolução do relacionamento? Quais?
- 7) Qual o grau de importância desta Empresa Cliente para a Embraer?

DÍADE EBR-FORNECEDOR

- 8) Há quanto tempo a EBR tem relações com este fornecedor de serviços?
- 9) Que tipo de relação a EBR tem com este fornecedor de serviços? Existe contrato para a prestação de serviços?
- 10) Quais fatores são(foram) importantes para a EBR escolher (ter escolhido) este Fornecedor de serviços?
- 11) Pode descrever um breve histórico da relação que a EBR estabelece (estabeleceu) com este Fornecedor de serviço?
- 12) Existiu uma relação diádica (entre EBR e este Fornecedor de Serviço) antes da relação com a Empresa Cliente? Quando começou?
- 13) O que a EBR espera de um fornecedor de serviços como este?
- 14) O(a) senhor(a) pode descrever o estágio atual da relação da EBR com este Fornecedor de Serviços em termos de evolução do relacionamento: 1) conscientização/reconhecimento do parceiro de negócio; 2) exploração/experimentação; 3) expansão; 4) compromisso e 5) dissolução?
- 15) O(a) senhor(a) percebe (percebeu) alguma mudança nos processos de negócio entre estas duas empresas ao longo do tempo de acordo com a evolução do relacionamento? Quais?

16) Qual o grau de importância deste Fornecedor de Serviço para a Embraer?

DÍADE FORNECEDOR- CLIENTE

17) Qual(quais) a(s) principal (ais) razão(ões) para o estabelecimento da relação entre o Fornecedor de Serviço e o Cliente da EBR?

18) Qual o papel da EBR na relação estabelecida entre o Fornecedor de Serviço e o Cliente da EBR?

19) Quais produtos/serviços este fornecedor oferece a esta Empresa Cliente?

• A RELAÇÃO TRIÁDICA:

EBR- NATAIR - FORNECEDOR

20) A partir de qual momento estas três empresas passam (passaram) a ter uma relação em conjunto? Pode nos descrever um breve histórico desta relação?

21) Quais motivos influenciam (influenciaram) para que as empresas desta tríade interajam (interagissem) entre si?

22) A relação entre as três empresas é estabelecida por algum tipo de contrato?

23) Como acontecem os processos de negócio nesta tríade? Como as relações são desenvolvidas? Qual a frequência de contato/interação entre as empresas?

24) Existem trocas de recursos (pessoas, equipamentos, produtos, serviços, estruturas, materiais etc.) na relação entre estas três empresas?

25) Qual o grau de interdependência que o(a) senhor(a) percebe entre estas três empresas?

- 26) Quais fatores são importantes para o desenvolvimento de relações de longo prazo entre estas três empresas?
- 27) Pode nos falar de circunstâncias sobre a evolução das relações das empresas nesta tríade, por exemplo: razões para início, razões de entrada/saída de cada empresa, razões para mudanças nas características das relações, razões para término etc.)?
- 28) Existem relações de poder/dependência entre as empresas nesta tríade?
- 29) Quais as principais fontes de conflito nas relações entre estas empresas?
- 30) Existem barreiras à saída deste relacionamento para alguma empresa desta tríade?
- 31) O(a) senhor(a) pode identificar eventos/acontecimentos maiores) dentro ou fora da tríade, com um efeito sobre a relação entre estas empresas? Este eventos/acontecimentos causam (causaram) alguma mudança nestas relações?
- 32) O(a) senhor(a) pode identificar ao longo do tempo pontos de mudança (positivos ou negativos) que influenciam (influenciaram) a forma de interação entre qualquer uma das empresas da tríade? Quais pontos de mudança foram estes? Houve consequências para a estrutura da tríade (natureza das trocas, pessoas envolvidas, dependência, questões de confiança, poder etc.)?
- 33) O(a) senhor(a) pode descrever algumas ações implementadas pelos gestores para gerir a evolução dos relacionamentos nesta tríade e os resultados destas ações?

34) O(a) senhor(a) acredita que as relações entre estas empresas podem ser desfeitas por influência de quais fatores?

APENAS PARA RELAÇÕES JÁ FINALIZADAS:

(PODE SER A SAÍDA DE APENAS UMA PARTE: FORNECEDOR OU
CLIENTE)

35) Caso a relação entre estas empresas já tenha se encerrado, quando esta teve fim?

36) O (a) senhor(a) pode descrever a(s) razão(ões) para o fim do relacionamento entre estas empresas?

APPENDIX 2

The script is presented in portuguese as the original language of the interviews.

Entrevista com gestores da NATAIR (empresa cliente)

PARTE 1 – SOBRE A NATAIR

A parte I deste roteiro tem por objectivo levantar dados sobre a empresa NATAIR e sua rede de negócios:

- 1) Quando a NATAIR foi fundada?
- 2) O que a NATAIR oferece aos seus clientes?
- 3) Como a NATAIR está estruturada?
- 4) Quais são os produtos e os serviços oferecidos pela NATAIR?
- 5) Consegue separá-los como ofertas independentes?
- 6) Quem são os clientes da NATAIR?
- 7) Como a NATAIR atua para atender as necessidades/problemas dos clientes?
- 8) A NATAIR busca relações com outras empresas para conseguir ofertar o que os clientes necessitam? Se sim, quem são estes parceiros?
- 9) Na relação com a EBR, quais fornecedores principais podem ser identificados?
- 10) Quais os tipos de interface existentes com cada um destes fornecedores? Quem são os responsáveis?
- 11) Como o(a) sr(a) pode descrever a rede de negócios da NATAIR na aviação comercial?

PARTE II – SOBRE O MODELO DE NEGÓCIOS DA NATAIR

A parte II deste roteiro tem por objectivo identificar o *Business Model* da NATAIR para a oferta de soluções de negócio, considerando-se os elos com os fornecedores e clientes.

ESTRUTURA DA REDE

- 1) Quais são os tipos de cliente a NATAIR possui (B2C; B2B ou ambos?)
- 2) Qual tipo de cobertura oferece (local/ regional/ nacional/ internacional)?
- 3) Qual a posição da empresa na cadeia de valor?
- 4) Qual a abrangência de mercado (mercado amplo/ múltiplos segmentos/ nicho de mercado)?
- 5) Qual a importância dos fornecedores no modelo de negócios da NATAIR?
- 6) Qual tipo de interação estabelece com clientes (transacional/ relacional)?
- 7) Qual tipo de interação estabelece com fornecedores (transacional/ relacional)?
- 8) Pode-se afirmar que o modelo de negócio da NATAIR é baseado em transações ou em relacionamentos?
- 9) Pode-se afirmar que o modelo de negócio da NATAIR é orientado à produção ou ao cliente?

OFERTA (SOLUÇÕES)

- 10) A NATAIR oferece principalmente produtos/ principalmente serviços / ou um misto?
- 11) A NATAIR oferece padronização/ alguma customização/ alta customização?
- 12) Como pode descrever a oferta da NATAIR em termos de soluções para o cliente?
- 13) Qual a importância das tecnologias para o modelo de negócio da NATAIR?
- 14) Quais as tecnologias consideradas estratégicas no modelo de negócio da NATAIR?

CAPACIDADES / HABILIDADES

- 15) quais capacidades ou habilidades são consideradas estratégicas?
- 16) Quais as fontes de competência (capacidades ou habilidades) que fazem a empresa ter melhor performance em comparação aos concorrentes?
- 17) Como a NATAIR acessa os recursos tangíveis que necessita?
- 18) Como a NATAIR acessa os recursos intangíveis que necessita?
- 19) Quais recursos são considerados estratégicos?

- 20) Como estão organizados os processos de negócio da NATAIR?
- 21) Existem sistemas de gestão?
- 22) Pode-se afirmar que o modelo de negócios da NATAIR é aberto ao acesso de recursos na rede de negócios?

MODELO DE LUCRATIVIDADE

- 23) Qual o modelo de lucratividade da empresa?
- 24) Qual o modelo de investimento da empresa?

CONFIGURAÇÕES DO MODELO DE NEGÓCIO

- 25) Com base nestas características descritas, quais as proposições de valor da NATAIR que a tornam única?
- 26) A EBR ajusta elementos de seu modelo de negócio de acordo as mudanças de mercado?
- 27) Como se pode descrever o modelo de negócio da NATAIR em relação fornecedor EBR?

PARTE III - COMPREENDENDO CADA TRIÁDE

A parte III deste roteiro tem por objectivo levantar dados sobre os relacionamentos diádicos e triádicos das empresas em estudo.

Entrevista para cada tríade. Deve ser respondida sobre as relações estabelecidas em cada tríade.

INDÚSTRIA: EMBRAER

CLIENTE: NATAIR

FORNECEDOR DE SERVIÇO: _____

- **AS RELAÇÕES DIÁDICAS:**

DÍADE NATAIR - EBR

- 1) Quais produtos/serviços esta empresa Cliente adquire da Embraer?
- 2) Há quanto tempo esta empresa Cliente tem relações com a Embraer?
- 3) Que tipo de relação esta empresa Cliente tem com a Embraer? Existe contrato para a prestação de serviços?
- 4) Pode descrever um breve histórico da relação que esta empresa Cliente estabelece (estabeleceu) com a Embraer?
- 5) O(a) senhor(a) pode descrever o estágio atual da relação desta empresa Cliente com a EBR em termos de evolução do relacionamento: 1) conscientização/reconhecimento do parceiro de negócio; 2) exploração/experimentação; 3) expansão; 4) compromisso e 5) dissolução?
- 6) O(a) senhor(a) percebe (percebeu) alguma mudança nos processos de negócio entre estas duas empresas ao longo do tempo de acordo com a evolução do relacionamento? Quais?
- 7) Qual o grau de importância da EBR para esta empresa Cliente?

DÍADE NATAIR - FORNECEDOR

- 8) Quais produtos/serviços este fornecedor oferece a esta Empresa Cliente?
- 9) Há quanto tempo este Fornecedor de Serviços tem relações com a Empresa Cliente?
- 10) Qual(uais) a(s) principal (ais) razão(ões) para o estabelecimento da relação entre o Fornecedor de Serviço e o Cliente da Embraer?
- 11) Pode descrever um breve histórico desta relação entre este Fornecedor de Serviços e a Empresa Cliente?
- 12) A relação entre este Fornecedor de Serviços e a Empresa Cliente é estabelecida através de contrato?

- 13) Existiu uma relação diádica (apenas entre este Fornecedor de Serviços e Empresa Cliente) antes da relação com a Embraer? Quando começou?
- 14) O(a) senhor(a) pode descrever o estágio atual da relação deste Fornecedor de Serviços com esta Empresa Cliente em termos de evolução do relacionamento:
1) conscientização/reconhecimento do parceiro de negócio; 2) exploração/experimentação; 3) expansão; 4) compromisso e 5) dissolução?
- 15) O(a) senhor(a) percebe (percebeu) alguma mudança nos processos de negócio entre estas duas empresas (Fornecedor de Serviços com esta Empresa Cliente) ao longo do tempo de acordo com a evolução do relacionamento? Quais?
- 16) Qual o grau de importância desta Empresa Cliente para este Fornecedor de Serviços?
- 17) Qual o papel da EBR na relação estabelecida entre o Fornecedor de Serviço e o Cliente da Embraer?

- **A RELAÇÃO TRIÁDICA:**

TRÍADE EBR- NATAIR - FORNECEDOR

- 18) A partir de qual momento estas três empresas passam (passaram) a ter uma relação em conjunto? Pode nos descrever um breve histórico desta relação?
- 19) Quais motivos influenciam (influenciaram) para que as empresas desta tríade interajam (interagissem) entre si?
- 20) A relação entre as três empresas é estabelecida por algum tipo de contrato?
- 21) Como acontecem os processos de negócio nesta tríade? Como as relações são desenvolvidas? Qual a frequência de contato/interação entre as empresas?

- 22) Existem trocas de recursos (pessoas, equipamentos, produtos, serviços, estruturas, materiais etc.) na relação entre estas três empresas?
- 23) Qual o grau de interdependência que o(a) senhor(a) percebe entre estas três empresas?
- 24) Quais fatores são importantes para o desenvolvimento de relações de longo prazo entre estas três empresas?
- 25) Pode nos falar de circunstâncias sobre a evolução das relações das empresas nesta tríade, por exemplo: razões para início, razões de entrada/saída de cada empresa, razões para mudanças nas características das relações, razões para término etc.)?
- 26) Existem relações de poder/dependência entre as empresas nesta tríade?
- 27) Quais as principais fontes de conflito nas relações entre estas empresas?
- 28) Existem barreiras à saída deste relacionamento para alguma empresa desta tríade?
- 29) O(a) senhor(a) pode identificar eventos/acontecimentos maiores) dentro ou fora da tríade, com um efeito sobre a relação entre estas empresas? Este eventos/acontecimentos causam (causaram) alguma mudança nestas relações?
- 30) O(a) senhor(a) pode identificar ao longo do tempo pontos de mudança (positivos ou negativos) que influenciam (influenciaram) a forma de interação entre qualquer uma das empresas da tríade? Quais pontos de mudança foram estes? Houve consequências para a estrutura da tríade (natureza das trocas, pessoas envolvidas, dependência, questões de confiança, poder etc.)?
- 31) O(a) senhor(a) pode descrever algumas ações implementadas pelos gestores para gerir a evolução dos relacionamentos nesta tríade e os resultados destas ações?
- 32) O(a) senhor(a) acredita que as relações entre estas empresas podem ser desfeitas por influência de quais fatores?

APENAS PARA RELAÇÕES JÁ FINALIZADAS:
(PODE SER A SAÍDA DE APENAS UMA PARTE: INDÚSTRIA,
FORNECEDOR OU CLIENTE)

- 33) Caso a relação entre estas empresas já tenha se encerrado, quando esta teve fim?
- 34) O (a) senhor(a) pode descrever a(s) razão(ões) para o fim do relacionamento entre estas empresas?

APPENDIX 3

The script is presented in portuguese as the original language of the interviews.

Entrevista com FORNECEDOR (empresa provedora de serviços)

INDÚSTRIA: EMBRAER

CLIENTE: NATAIR

FORNECEDOR DE SERVIÇO: _____

- **AS RELACÕES DIÁDICAS:**

DÍADE FORNECEDOR - EBR

- 1) Quais produtos/serviços este fornecedor de serviços oferece para a indústria aeronáutica?
- 2) Há quanto tempo este fornecedor de serviços tem relações com a EBR?
- 3) Que tipo de relação este fornecedor de serviços tem com a EBR? Existe contrato para a prestação de serviços?
- 4) Pode descrever um breve histórico da relação que este Fornecedor de serviço estabelece (estabeleceu) com a EBR?
- 5) Existiu uma relação diádica (entre EBR e este Fornecedor de Serviço) antes da relação com a Empresa Cliente? Quando começou?
- 6) O(a) senhor(a) pode descrever o estágio atual da relação da EBR com este Fornecedor de Serviços em termos de evolução do relacionamento: 1) conscientização/reconhecimento do parceiro de negócio; 2) exploração/experimentação; 3) expansão; 4) compromisso e 5) dissolução?
- 7) O(a) senhor(a) percebe (percebeu) alguma mudança nos processos de negócio entre estas duas empresas ao longo do tempo de acordo com a evolução do relacionamento? Quais?
- 8) Qual o grau de importância da EBR para este Fornecedor de Serviço?

DÍADE FORNECEDOR-NATAIR

- 9) Quais produtos/serviços este fornecedor oferece a esta Empresa Cliente?
- 10) Há quanto tempo este Fornecedor de Serviços tem relações com a Empresa Cliente?
- 11) Qual(quais) a(s) principal (ais) razão(ões) para o estabelecimento da relação entre o Fornecedor de Serviço e o Cliente da Embraer?
- 12) Pode descrever um breve histórico desta relação entre este Fornecedor de Serviços e a Empresa Cliente?
- 13) A relação entre este Fornecedor de Serviços e a Empresa Cliente é estabelecida através de contrato?
- 14) Existiu uma relação diádica (apenas entre este Fornecedor de Serviços e Empresa Cliente) antes da relação com a Embraer? Quando começou?
- 15) O(a) senhor(a) pode descrever o estágio atual da relação deste Fornecedor de Serviços com esta Empresa Cliente em termos de evolução do relacionamento: 1) conscientização/reconhecimento do parceiro de negócio; 2) exploração/experimentação; 3) expansão; 4) compromisso e 5) dissolução?
- 16) O(a) senhor(a) percebe (percebeu) alguma mudança nos processos de negócio entre estas duas empresas (Fornecedor de Serviços com esta Empresa Cliente) ao longo do tempo de acordo com a evolução do relacionamento? Quais?
- 17) Qual o grau de importância desta Empresa Cliente para este Fornecedor de Serviços ?
- 18) Qual o papel da EBR na relação estabelecida entre o Fornecedor de Serviço e o Cliente da Embraer?

• A RELAÇÃO TRIÁDICA:

TRÍADE EBR-NATAIR - FORNECEDOR

- 19) A partir de qual momento estas três empresas passam (passaram) a ter uma relação em conjunto? Pode nos descrever um breve histórico desta relação?
- 20) Quais motivos influenciam (influenciaram) para que as empresas desta tríade interajam (interagissem) entre si?
- 21) A relação entre as três empresas é estabelecida por algum tipo de contrato?
- 22) Como acontecem os processos de negócio nesta tríade? Como as relações são desenvolvidas? Qual a frequência de contato/interação entre as empresas?
- 23) Existem trocas de recursos (pessoas, equipamentos, produtos, serviços, estruturas, materiais etc.) na relação entre estas três empresas?
- 24) Qual o grau de interdependência que o(a) senhor(a) percebe entre estas três empresas?
- 25) Quais fatores são importantes para o desenvolvimento de relações de longo prazo entre estas três empresas?
- 26) Pode nos falar de circunstâncias sobre a evolução das relações das empresas nesta tríade, por exemplo: razões para início, razões de entrada/saída de cada empresa, razões para mudanças nas características das relações, razões para término etc.)?
- 27) Existem relações de poder/dependência entre as empresas nesta tríade?
- 28) Quais as principais fontes de conflito nas relações entre estas empresas?
- 29) Existem barreiras à saída deste relacionamento para alguma empresa desta tríade?
- 30) O(a) senhor(a) pode identificar eventos/acontecimentos maiores) dentro ou fora da tríade, com um efeito sobre a relação entre estas empresas? Este eventos/acontecimentos causam (causaram) alguma mudança nestas relações?
- 31) O(a) senhor(a) pode identificar ao longo do tempo pontos de mudança (positivos ou negativos) que influenciam (influenciaram) a forma de interação entre qualquer uma das empresas da tríade? Quais pontos de mudança foram estes? Houve consequências para a estrutura da tríade

(natureza das trocas, pessoas envolvidas, dependência, questões de confiança, poder etc.)?

32) O(a) senhor(a) pode descrever algumas ações implementadas pelos gestores para gerir a evolução dos relacionamentos nesta tríade e os resultados destas ações?

33) O(a) senhor(a) acredita que as relações entre estas empresas podem ser desfeitas por influência de quais fatores?

APENAS PARA RELAÇÕES JÁ FINALIZADAS:
(PODE SER A SAÍDA DE APENAS UMA PARTE: INDÚSTRIA,
FORNECEDOR OU CLIENTE)

34) Caso a relação entre estas empresas já tenha se encerrado, quando esta teve fim?

35) O (a) senhor(a) pode descrever a(s) razão(ões) para o fim do relacionamento entre estas empresas?

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